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Working the old hulk out of the cofferdam, a portion of which may be seen at the right.

THE LAST OF THE "MAINE."—[See page 288.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Regulating Wireless Telegraphy

THE introduction of a bill by Senator Bourne to regulate radio-communication brings up the interesting question as to how far a government should be permitted to utilize a brilliant invention for warlike purposes at the expense of peaceful commercial interests. A wide difference of opinion exists upon this point in its relation to wireless telegraphy. Those who see a war cloud ever hovering above predict national disaster unless the navy department is given absolute control of the new science. Others with visions of perpetual peace and good will on earth demand freedom from the influence of the bugbear of war. The question of wireless regulation, however, includes not only the matter of national defense, but also the need of responsible regulation to save the public from the dangers and inconveniences of irresponsible commercial competition, and this because of the peculiar conditions under which the activity is conducted.

However the case may be argued by either side, it is generally admitted that our naval wireless system cannot be dispensed with and must be regarded as a permanent institution. It is also generally admitted that since the time is not ripe for government ownership of telegraph utilities, the commercial and naval systems must co-operate to remedy the impossible operating abuses existing at the present time. Mr. Bourne believes that a practicable solution can be attained by placing the absolute control of commercial systems in the hands of the Secretary of Commerce and Labor. To guide the Secretary in the rather large task thus imposed, Mr. Bourne thoughtfully includes in his bill numerous technical propositions. Little can be said for these save that they reflect the good intentions of their sponsor rather than his knowledge of the needs of the occasion. The rules for wave lengths, power, and distances are, according to expert testimony, not only inadequate to remedy present "interference" evils, but they form an inflexible code that would be likely to prove a stumbling block for future scientific improvements. The bill has the support of the navy department, while against it are arrayed not only every commercial and private interest, but the very men, including Mr. Marconi, who have developed the art to its present usefulness. Aside from the objectionable nature of the technical regulations, the official tone of the other articles, and the intense solicitude for the welfare of the "naval and military stations" destroys the value of the bill.

This question of radio-telegraphy is too big for settlement through legislative "jokers" and divers untechnical committees. The reports of wireless committee conferences, ludicrous in the extreme from a scientific standpoint, prove this fact. Just what shall be the logarithmic decrement of a wireless telegraph station under given conditions is not a point to be decided in the House of Representatives. This form of technical legislation is never justified when other means of obtaining results are available. In the present case a decidedly better method is at hand, a method which calls for the creation of a permanent wireless commission, scientific in nature, and composed of representatives of all wireless interests to

be affected by its rulings. Such a wireless conference could not only meet the present needs fairly and squarely, but could keep pace with scientific progress. A bill creating such a commission with power of recommendation to the Secretary of Commerce and Labor would be welcomed as the first sensible step toward a scientific solution of wireless difficulties.

Dr. Wiley's Resignation

THAT Dr. Wiley performed a very useful work in arousing public interest in the very vital matter of pure food products and that he has filled a difficult office honestly and energetically, even his numerous enemies must admit. His resignation should enable the President to clean thoroughly one of the worst Augean stables ever included in a governmental department. There has been so much backbiting, so much working at cross purposes, so much personal rancor, and above all, so little real disinterested science, in the work of Dr. Wiley's subordinates, that no scientific man takes the Bureau of Chemistry seriously. We hold no brief for benzoate of soda or boracic acid; but we firmly believe that had it not been for the Remsen Board, we should have had but very little accurate knowledge of the effect of certain preservatives on foods.

Now that Dr. Wiley has resigned, we hope that the curious and expensive anomaly of a Bureau of Chemistry entrusted with the care of 90,000,000 stomachs, and of a Board of Referees to check up its work, will be abolished. There would be no need of a Remsen Board if the pseudo-scientists in the Bureau of Chemistry were removed.

Dr. Wiley's Pure Food and Drug Act is the finest piece of legislation that this country has seen in many a day; but it has been all but vitiated, not only by wealthy dishonest food manufacturers, but by unscientific and incompetent government officials. What the Bureau of Chemistry needs is a man whose personality will be as strong as that of Dr. Wiley's, who will be as honest and fearless as he, but, above all, a man of such solid scientific attainments that there will be no need of referring his decisions to a Board of Referees. Not one of the men upon whom Dr. Wiley leaned for assistance during the later years of his exciting administration is capable of filling the office of Chief of the Bureau of Chemistry satisfactorily. Unless a scientist is appointed, the Bureau of Chemistry will continue its old policy of accusing first and later getting evidence to substantiate its accusations.

The Wassermann-Ehrlich Cancer Researches

IT may almost be said that Ehrlich's principle of chemotherapy has established a new era in medical science. By its substances are found which have a greater affinity and toxicity for parasitic or disease cells than they have for the host. A certain fruition thus far of this principle is the drug salvarsan, which is positively curative of one of the most dreadful of human diseases.

It is this principle of chemotherapy which Wassermann has applied in experimenting upon malignant tumors in mice. One finds always in such growths (cancer or sarcoma), either in mice or in men, "tumor cells" which are abnormal and are manifestly essential elements of the diseased process. Wassermann has discovered that a compound of eosin and selenium, when in contact with such tumors, is taken selectively by the tumor cells. Daily injections of this substance into the blood stream of cancerous mice causes first a softening of the tumor, and then its total resorption within ten days. The tumor must not be too large in proportion to the body weight of the animal—in the mouse not beyond the size of a cherry. With larger tumors the drug gives severe, even fatal intoxication, which is apparently the result of rapid absorption of the product of disintegration of the tumor cells. In the recovered animals, after several months' observation, the tumors have totally disappeared without any recurrence; it was found, however, that when insufficient treatment had only partly disposed of the tumor cells, recurrence of the growth took place.

Hitherto such tumors have seldom, if ever, disappeared spontaneously or under the influence of any form of treatment. It seems that Wassermann and his associates are justified in their claims to have cured cancer in mice. Unquestionably their investigations justify the hope of a cure of human cancer. Yet it were cruel indeed not to add that we have here but the beginning of a long series of most arduous experiments, which must consume years and in which bacteriologists, chemists, path-

ologists, and clinicians must co-operate. Nor can we too much laud the essential humanity inherent in this conservative statement of Wassermann: "We wish most particularly, in order to prevent false hopes and excitement among persons with tumors, to point out emphatically that at the present time we have no evidence that this substance will act in the same way with human cancers. This question we have not yet investigated. It may not be impossible that an essential beginning has been made and a solid foundation established, extension of which along these lines may yield progress in human therapy."

Science in a Passion

A FRENCH physician was recently reported to have declared before the Paris Academy of Medicine that the medicament salvarsan, which was elaborated by the Teuton Ehrlich, is "deadly and of small therapeutic efficiency, that numerous deaths have resulted from its administration, and that these casualties have been purposely suppressed." Such a statement is vehement and exaggerated, and apparently rancorous. It may now be definitely stated that salvarsan is an inestimable and a very beneficial discovery.

To even up matters one must note the stubborn opposition of German physicians to the method of purifying milk which bears the name of the illustrious Frenchman Pasteur—a method now clearly established as a most blessed preservative of infant life. It is by reason of such prejudice that infant mortality is still much higher in Germany than in our own country, or even in France!

The English temperament had its innings in a vituperative letter from a Canadian physician, stigmatizing those "Dutchmen who claim all discoveries." And to complete the record, we note a cable to the effect that Russian physicians belonging to the "black hundred" have carried their anti-semitism to the absurd point of refusing to accept the findings of Wassermann and Ehrlich, whose work upon mice gives promise of a cure of cancer in man. It is most refreshing to observe the almost complete absence of such acrimony among American physicians.

Nor are other fields of science any freer from unprofitable discord. Recall only the bitter European controversy of a decade ago over Blondlot's discovery of the N-ray; how two camps were formed—the Gallic and the Teutonic. Statements unmistakably opprobrious in intent were forthcoming. Compliments increased in warmth as they lost in polish. Blondlot's adherents imputed prejudice and animosity to their foreign critics; the rays could be distinguished only by the more delicate and sensitive Gallic psychism; while what, on the other hand, was to be expected—*sacre bleu!*—of the fog-bemuddled British brain, or of beer-befuddled German cerebration. It was a veritable replica of our own immortal *Row Upon the Stanislaus*; and it enhanced the gayety of nations nearly to the same degree.

Calm-eyed science, engaged in rapt contemplation of the truth, and nothing but the truth, is ever intolerant of personalities and provincialisms in her realm. Such contentions grievously impair the dignity of her votaries; and what is vastly more unfortunate, mankind loses by reason of them much of the good in untrammelled and cordial co-operation among scientists.

Admiral Melville

FULL of years and honors, Rear Admiral George W. Melville has passed into the great beyond. His was a career eminently useful to his country, to science and to the world. It is not given to many men to enrich, as he did, more than one department of thought. He achieved fame by his heroic efforts to save the remnant of the DeLong party in the Arctic regions. The very able scientific work that he performed on later Arctic expeditions alone would serve to keep his name alive. As the Chief Engineer of the United States Navy, however, he performed his most useful service. He saw to it that the American warship has literally kept pace with those of foreign construction. His fresh mind was ever ready to seize those improvements in steam engineering that seemed worthy of practical application, but he also contributed to the development of marine engineering in more original ways. His triple-screw vessels have not proven successful, but the reduction gearing for marine steam turbines with which his name is associated stands to-day as a brilliant solution of a most difficult problem that has been presented by the marine applications of the steam-turbine.

Electricity

Water Power in Norway.—According to recent reports the amount of water power which is in the way of preparation in Norway is 500,000 horse-power, in addition to the existing 430,000 horse-power. Many large projects for hydraulic work upon the large streams have been the subject of franchises granted during the last few years, and such work is now about finished. The hydraulic work on the Mjösen is completed, and another enterprise on the Samnanger stream is soon to give the city of Bergen a large amount of electric current.

Detecting Bichromate of Potash Electrically.—As small an amount as one two hundredth millionth of substances such as bichromate of potash in solution can be detected by a new electric method. M. A. Grumbach of Paris states that he puts a few drops of such solution in a vessel with sulphuric acid, connected by a capillary tube with a like vessel having untreated acid. Wires dip into each vessel and go to a capillary electrometer, which is very sensitive and measures as low as 1-20,000 volt, such as the present arrangement will give. The amount of bichromate was about 1-200,000,000. The electrical effect depends on the quantity of bichromate in general.

Electric Elevators for Paris Subway Stations.—Electric elevators as well as rolling staircases for subways are being used in several of the underground stations at Paris, where the tunnel lies at such a depth that there are many stairs to climb before reaching the surface. The elevators are mounted at the République and La Cité stations and are very well liked by the public, as no time is lost and the mounting is done very quickly. One elevator rises while the one alongside is coming down. A special corridor leads from the station platform to the elevators. At the arrival of each train one of the elevators is in readiness, and it is filled and started up within a very short time. Another method is used at the Père Lachaise station, this being a rolling staircase of the usual kind.

Electric Cooking on Railroad Trains.—Electricity has been applied in a new way to increase the comfort of railway travel by the introduction of electric cooking devices on the dining cars of certain fast trains between Chicago and the Northwest. A feature of the service is that the passengers are encouraged to display their culinary skill. Connection to the lighting current of the train, which is supplied by a steam turbine generator set, is made at an outlet at every table to which the usual devices—frying pan, water heater and egg boiler, chafing dish, teakettle, toaster, coffee percolator—are connected. Apart from the diversion of thus varying the monotony of a long railroad trip, food prepared in the kitchen is maintained in good condition by electrically heated receptacles.

Ultra-violet Light Water Sterilization on a Large Scale.—Ultra-violet light has been employed to sterilize water on a large scale in France, in a plant required to deliver 261.5 cubic yards of water per twenty-four hours. The apparatus utilizes the copious emission of these short waves from a mercury-vapor lamp having a quartz tube. More than three-quarters of the rays coming from the special lamp are utilized, and sterilization to the point of leaving one germ to the cubic centimeter is accomplished by causing the water to traverse a zigzag path close to the lamp, thereby exposing it to the repeated action of the waves. The test showed that the process was highly efficient for municipal purposes. It is low in cost and simple in operation, occupies little space, uses a very small amount of electric current, and imparts no taste to the water, which remains fresh, since it retains its dissolved air and has not been heated in any way. For municipal water service the apparatus may be applied to the outside of the ordinary main, the radiations being transmitted through quartz windows in the main.

Self-inductance of Non-ferrie Coils.—A universal formula for determining the inductance of all forms of closely wound cylindrical coils without iron cores has been developed by Prof. Morgan Brooks of the University of Illinois. This formula gives an accuracy to within three per cent, an error corresponding to the mechanical variation in winding commercial coils and to the average error in resistance formulas which take no account of change of temperature. Non-ferrie inductance coils have an increasing use for electrical work of all kinds, as their advantages over iron-core coils, disclosed by oscillograph records, are better appreciated. Such coils have greater magnetic properties than is generally supposed, and they are free, of course, from "core loss." Moreover, they have a greater alertness and certainty of action—a valuable feature in choke coils for the protection of power-station apparatus. The new formula is a useful one to busy engineers, since it avoids the errors—in some instances serious—of using a theoretical formula for a coil of different shape from the one in question.

Science

An Acid-proof Metal.—It is reported that a chemist employed by the Carnegie Steel Company has produced an alloy which cannot be attacked by sulphuric acid. How much truth there is in this statement we have not as yet been able to determine.

Neo-salvarsan.—Dr. Ehrlich announces that he has discovered a method of dissolving salvarsan more readily than has hitherto been possible. The resulting solution in water is entirely neutral. The old solution was alkaline and caused considerable pain when injected, sometimes destroying the surrounding tissues. Many of the reported failures have been due to the difficulty of mastering the technique of administering the solution properly. These difficulties are now removed.

Dr. Henry W. Spangler.—Dr. Henry W. Spangler, Dean of the Department of Electrical and Mechanical Engineering of the University of Pennsylvania, died on March 18th. He was fifty-four years old. He graduated from the United States Naval Academy in 1878, and was an engineer officer in the navy from 1878 to 1891. He is best known for his work on steam engine economy, cyclical changes in temperature in steam engines, the strength of flat plate, and the effect of high temperature on superheating boiler tubes.

Major Squier to Go to London.—Major George O. Squier, of the United States Signal Corps, has been appointed military attaché to the American Embassy in London. Major Squier, who is a Ph.D. of Johns Hopkins, enjoys a unique reputation among military men for brilliant investigations and inventions in electrical engineering and other branches of applied physics. He is the inventor of a system of multiplex telegraphy and telephony recently described in the SCIENTIFIC AMERICAN SUPPLEMENT.

A New Way of Generating Illuminating Gas.—It is reported that illuminating gas is to be made in Austria by a somewhat unusual process, and for this purpose a plant is being erected at the town of Brunn, where gas is produced by distilling dried sediment from sewer water. The method is due to the researches of Prof. Honig, who discovered that a cubic yard of sewer water contained in suspension a solid substance which can be made to give off gas like coal or peat. It is claimed that such gas has a very high heating power, and this is even greater than coal gas.

Mussel Mud as a Fertilizer in Canada.—In most of the bays indenting the shores of Prince Edward Island are found extensive deposits of mussel mud, so called locally, being organic remains of countless generations of oysters, mussels, clams and other shell fish. The shells, usually more or less intact, are found imbedded in dense deposits of a mud-like substance, and this combination is a fertilizer of high value and potency. It supplies lime and organic matter, besides small quantities of phosphates and alkalies. An ordinary dressing of it has a very marked beneficial effect on the poorest and most exhausted soils. The shells decay slowly, year by year, throwing off a film of fertilizing materials. The deposits around Prince Edward Island vary from 5 to 25 feet in depth. They are taken up by dredging machines, worked from rafts in summer, or from the ice in winter.

Lenses With Plane Surfaces.—Ordinary lenses are made of homogeneous material, such as glass or occasionally liquid, and the optical properties, such as convergence and divergence, are secured by imparting to the surfaces of the lenses a suitable curved shape, usually spherical. Theoretically, it is obviously also possible to produce a lens by using material in the form of plates, bounded by plane surfaces, provided that the material is not homogeneous but graded in a suitable manner as regards its refractive index. This has been actually carried out in practice by Prof. Wood, whose process consists in first of all melting a piece of gelatine, such as that used for photographic films, and filtering the material through a tuft of cotton wool. The gelatine is then allowed to solidify in a test tube. The next step is to heat it until the mass acquires a syrupy consistency, and then to add an equal volume of glycerine. When the material has set solid the bottom of the test tube is broken and the gelatine is extracted and cut into disks. These are placed between two glass plates and then immersed in water. This latter diffuses into the gelatine, expelling the glycerine. As this action starts from the surface and extends inward, there is a graded change in the refractive index produced from the surface inward. The cylinders so produced act as converging lenses. In a somewhat similar way diverging lenses can be produced. Glass lenses constructed on a similar plan can also be made by taking advantage of the inequalities in density produced by the sudden chilling of glass. Whether lenses of this kind have found any practical application, *Le Temps*, the source from which we derived our information, does not state.

Aeronautics

The Long-distance Balloon Record.—After some correspondence with the Kleff Aeronautic Society, the Aero Club of France has accepted and made official the record of 1,953.898 kilometers as the distance covered by Emile Dubonnet in his long-distance balloon trip from Lazimotte-Brulle, France, to Sokolowska, Russia, on January 7th and 8th last. This corresponds to 1,214,003 miles, and is the world's record for distance. Dubonnet wins the Lahm cup, and the Aero Club of France has awarded him a special medal.

The Second Trans-continental Flight.—On the 15th ult., by his 18-mile flight from Jacksonville, Fla., to Pablo Beach in 19 minutes, Robert G. Fowler completed the second flight across the continent, and the first from the Pacific to the Atlantic. He left Los Angeles four months before in his Wright biplane, having made a second start from the more southern point after he had twice started from San Francisco and tried to scale the Rockies. He met with many delays on account of breakdowns and bad weather, but finally arrived at Jacksonville on February 8th after a 90-minute flight from Quitman (82 miles). Max Lillie, on a Wright, and Harold Kanter, on a Moisant monoplane, met him in mid-air. Altogether Fowler covered some 3,800 miles in 118 days, although the air line distance between towns amounts to but 2,500. He took many moving pictures while in flight in the South.

Vedrine's Latest Speed Records.—After making a number of new records on Washington's birthday, Jules Vedrine, with his Deperdussin monoplane, continued to break records at Pau, France. On the 28th ult. he was unofficially timed for a distance of 10 kilometers at a speed of 167.25 kilometers per hour. The following day he was obliged to descend after traveling 50 kilometers, his best speed being 162.45 kilometers per hour. On March 1st he raised his speed average to 166.821 kilometers an hour. He continued flying for two minutes over the hour, and in 1:01:55 covered a total of 170 kilometers (105.63 miles). The new records made appear in the following table:

Kilometers.	New Records.		Old Records.	
	Min.	Sec.	Min.	Sec.
10	3	35 4/5	3	43 1/5
20	7	14	7	27
30	10	53 4/5	11	10 2/5
40	14	32 1/5	14	54 2/5
50	18	10 2/5	18	38 2/5
100	36	23 1/5	37	22 2/5
150	54	35 3/5	56	17

The records for 1/4, 1/2 and 1 hour were raised to 40.374, 80.374, and 164.431 kilometers, respectively. The following day Vedrine, when officially timed, raised his record for 10 kilometers (6.21 miles) to 167.91 kilometers per hour (104.33 miles per hour). He required but 3 minutes 34 2/5 seconds to make this distance, which was one circuit of the course.

Use of Aeroplanes in Warfare.—One of the few authentic reports of the successful use of aeroplanes in warfare, is to the effect that on the night of January 17th last a party of 400 Arabs attacked a block house held by eighteen Italians at Benghazi. During the fight Lieut. Gavotti flew over the Arabs in his Farman biplane and dropped several bombs with such good effect that the enemy speedily retired, leaving a number of wounded men behind. An elaborate description has been given by Giuseppe Rossi, whose monoplane was hit five times by Arab bullets, of the flight over the enemy's camp at Tobruk, Tripoli, in the course of which his companion, Capt. Montu, was severely wounded. The flight was made on the morning of January 31st. It was for the purpose of reconnoitering and also to test a new bomb. The camp was about eighteen miles away, but the aviator discovered a group of Arabs before half this distance had been covered. These Arabs fired upon the aeroplane, which was at a height of 1,800 feet, but the aviator kept on until the camp was reached. At a given signal Capt. Montu dropped a bomb, and both he and the aviator were congratulating themselves over the damage they had done, when the Arabs fired several volleys. One of the bullets struck Capt. Montu, who shouted that he was wounded. Just then the motor failed and Rossi feared that he would drop. Fortunately the motor started again and the men were able to return to headquarters, despite an unfavorable wind which greatly hindered their progress. On March 18th, after making valuable observations, Italian airmen again dropped bombs on some Arabs when the latter fired upon the aeroplane. Ten men are reported to have been killed and a number of others injured. The aeroplane returned to camp unscathed. On the 20th two Italian dirigibles made two reconnoissances above the Turkish lines. At Lanzour, 14 miles west of Tripoli, four people were killed and ten wounded by a bomb dropped in the streets. Heavy rifle fire caused the airships to withdraw, but on their second trip later they dropped 30 more bombs.

How Detective Burns Listened to Dynamiter Plots

Instruments That Can be Used for Eavesdropping or for Business Purposes

IT has been the impression of the public that the dictograph is a very complicated mechanism for automatically and unerringly recording the conversation carried on near it. In general the mechanism employed is quite simple and easily understood. In fact there is no new principle involved. The invention is an adaptation of well-known apparatus to a peculiar purpose or situation.

The instruments are of three general types. First is the type shown in Fig. 1, sometimes modified as shown in Fig. 2. This is the type of apparatus referred to by Detective Burns in his dynamiting cases. It is really nothing more than a simple telephone circuit arranged to convey sounds from the talking station shown on the left to the listening or recording station on the right. Sometimes the transmitter is mounted in an innocent-looking square or triangular box, divided into two compartments. Within one compartment is room enough for small size dry batteries and for storing the receiver when the apparatus is not in use or is being carried about from place to place; within the other is located the transmitter element. One wall of this second compartment of the box is, in reality, a thin diaphragm, with which is connected the microphone or resistance-varying element, usually a sensitive granular carbon transmitter button or cup. The size of the box is quite immaterial, but it is evident that the larger the diaphragm, the greater is the area of the sound-wave acting upon the transmitter element, and hence the better and stronger the reproduction of the sound at the receiving end of the line.

This is the type of instrument said to have been used by the famous Detective Burns and his associates in the MacNamara case and the so-called Lorimer-Hines bribery case. In each case the method of operating the device was somewhat as follows: Burns or any of his associated detectives "rigged up" a few rooms in a hotel. Appointments were made with suspects and accomplices. In one room in which the conversation or consultation was held there was located the little transmitter disposed in a convenient but inconspicuous position; in the adjoining room the receiver of the instrument was placed, and an expert stenographer with the receiver to his ear took down the conversation carried on by the detective and the suspect in the other room. Thus, it is declared, very valuable evidence was gathered. Indeed the success of the case is said to have depended upon the use of this ingenious device.

The use of this form of apparatus with slight modification has been applied to large auditoriums and churches. Instead of using a single transmitter and a single receiver, as shown in the figure, a number of transmitters placed at various points about the stage or pulpit are arranged to gather the sounds and transmit to persons at remote parts of the hall the voices of the speakers or the strains of the orchestra. As many receivers as may be required are connected into the circuit to reproduce the sound at the remote points.

A somewhat similar apparatus is employed for announcing trains in the waiting rooms of large railway stations. The train announcer speaks into a transmitter and the sound waves are electrically reproduced by means of loud-speaking telephone receivers placed at various points about the great hall or waiting room. It is remarkable how clearly the voice is transmitted, for the announcement can be clearly and distinctly heard in every part of the immense room reverberating sonorously amid the huge marble pillars.

In a modified form, as shown in Fig. 2, the apparatus is employed in large business offices between a manager's desk or office in one room and a stenographer's desk in another room for the purpose of expeditiously dictating letters and transmitting intelligence of any kind. In this case the apparatus is really nothing more than an intercommunicating telephone system, for speech can be transmitted in both directions. Various switches are employed for connecting the apparatus of any one of a number of stenographers' desks with the manager's instrument.

The second broad class is shown diagrammatically in Fig. 3. This is an arrangement combining the use of the telephone and phonograph. This type of instrument is often known as the "telephonograph," and in practice it assumes a number of different forms. In each case the principle is the same as that outlined in the figure. As soon as the telephone and the phonograph were invented the combined use of the two instruments suggested itself to a number of inventors. As early as February, 1889, there were public exhibitions of such use of the two instruments in combination. In a lecture before the Franklin Institute at

Philadelphia Mr. William J. Hammer performed the following experiment: A phonograph at New York was set to talk into a carbon transmitter, sending current waves over a telephone line to Philadelphia a distance of 103 miles to the audience at the Franklin Institute. At that station a loud-speaking receiver talked into another phonograph and then in turn delivered to the amazed audience the tones of the original speaker in New York city.

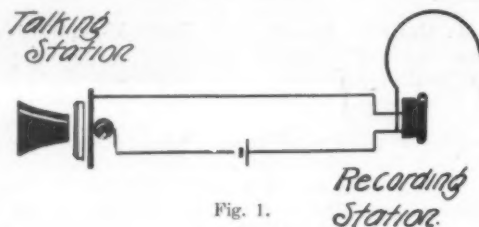


Fig. 1.

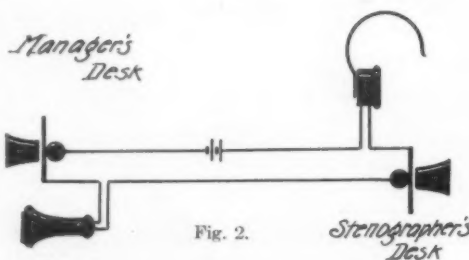


Fig. 2.

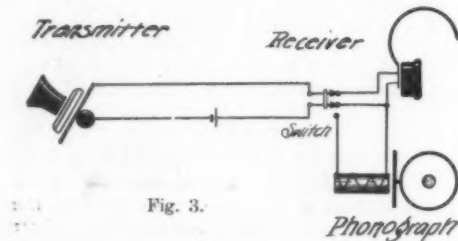


Fig. 3.

Various forms of dictographs.

No great practical use has been found for this combined instrument due to the great difficulty of keeping a suitable surface constantly in motion ready to record the sound waves. Furthermore much of the apparatus is too large and cumbersome to be conveniently portable, due largely to the size and weight of the motor mechanism for driving the cylinders. It was early proposed to apply this instrument to the ordinary telephone to keep a record of the conversations passing over the line. This was to be especially useful in keeping a record of these conversations for subsequent use in legal controversies. It would be too easy, however, to manufacture such a record. At present an application of such device is found in some systems of telephone exchanges. A continuously operating phono-

graph is used as a "busy-test." If the subscriber calls a busy line he is automatically connected at the central station with this phonograph, which continuously repeats the well-known ditty, "the line is busy, please call again." Another use of this type of instrument has been made in certain automatic fire-alarm installations. In this case thermostats are arranged to close a circuit at a predetermined temperature. This circuit controls the operation of a phonograph device, connecting it with the nearest telephone line. Arranged on the cylinder of this instrument is the message to be transmitted to the central station or to the nearest fire station. Such record may contain suitable words as "there is a fire at No. 99 Park Row." The instrument is arranged first to signal central and then to repeat this message a number of times. "Central," upon receiving such a message, connects the line directly with fire headquarters and thus, automatically, an alarm is sent in almost instantaneously. With this arrangement it is evident that a subscriber would be apprised of the fire call if he were using the telephone line and would immediately stop his conversation and hang up his receiver to allow the call to continue to "central."

The third type of instrument is the dictating phonograph. This has nothing in common with the dictograph used by Detective Burns. The instrument consists of a stand or frame upon which is mounted a cylinder-bearing mechanism and a motor mechanism. By means of a foot-control, which is not clearly shown in the photograph, the motor (either spring or electrically driven) is started and stopped. The speaker sits at a table with his notes before him and speaks into an adjustable tube.

One of these instruments of the kind shown in Fig. 4 was used before the Senate Committee on Interstate Commerce. It was before this committee and recorded upon such a machine that George W. Perkins, many times a millionaire, and formerly business partner of J. Pierpont Morgan, and admitted to be a great authority on organized industry, made his remarkable statement that he had retired from business at the age of 48 because he was tired of making money and that he was devoting the rest of his life to a study of how to do good for the rest of mankind.

The machines as used are employed merely as an intermediate step between shorthand notes and a complete typewritten copy. Expert and highly paid stenographers took down in shorthand notes the name and the exact words of the speaker. These stenographers worked in shifts, each man taking stenographic notes for about an hour at a time. He would then take his written notes to an adjoining room and read them slowly and distinctly into the dictograph instrument, fresh cylinders being supplied whenever needed. By this means a very clear and uniform dictation resulted. A typist took this prepared cylinder to a similar machine arranged to reproduce the sound and transcribed at her leisure the words of the original speaker. By this means a great deal of time was saved since the transcribing could be done by a number of typists. The witnesses called before the committee at 10:30 were thus enabled late in the afternoon to read and correct the original testimony, and each day's work was thus made complete in itself.

Facts About Breathing

THE amount of air breathed in at one normal inhalation of an average male adult is 500 cubic centimeters, or 30.5 cubic inches; but when taking vigorous exercise, seven times as much.

The total area of the lung surfaces is about 30 square meters or 323 square feet; that of the body, however, only 2 square meters or 21.53 square feet.

An adult breathes ordinarily in a minute, about 18 times; when doing ordinary physical work, 25 times; when taking vigorous exercise, 60. In case of inflammation of the lungs the respiration takes place at the rate of about 40 breaths a minute.

In the nasal passages the air is warmed more rapidly and thoroughly than when it passes into the lungs through the mouth. Air at a temperature of 6 deg. Cent. = 42.8 deg. Fah. is raised to 32 deg. Cent. = 89.6 deg. Fah. during the short time of an inhalation through the nose. The reason of the more thorough warming by nasal breathing is that the total surface of the nasal passages in the average adult is 100 square centimeters or 15.5 square inches; those of the mouth having an area of only 70 square centimeters or 10.85 square inches. So the nasal passages have $\frac{100}{70}$ or 42.85 per cent more surface, hence greater effective warming power, than the oral.



Fig. 4.—Machine used for dictation.



View, from the Jungfrauoch station, toward Grindelwald and Eiger.



View, from the Jungfrauoch tunnel, of Aletsch glacier.

Piercing the Jungfrau Tunnel

A Remarkable Engineering Feat in the Swiss Alps

By Dr. Alfred Gradenwitz

ANOTHER important step was made on February 21st in man's relentless struggle with the forces of Nature, when the huge tunnel traversing the Mönch and terminating at Jungfrauoch, at 11,410 feet above sea level, was pierced.

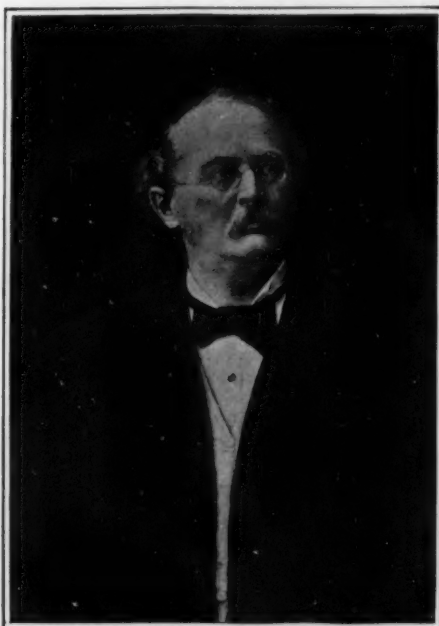
Drilling and blasting inside the rocky breast of that alpine giant, at more than 10,000 feet altitude, had been going on patiently day and night, summer and winter, for many months, the average daily advance being 10 to 12 feet. Strange to say, this work so high above any human abode, did not offer any serious inconvenience, the gallery being as dry as could be desired, while the temperature, in spite of the enormous altitude and the great rareness of the air, even in winter, hardly fell to the freezing point, though at the same altitude outside of the rock, the thermometer would register 25 deg. Cent. below zero. Only during the last few days did the temperature inside the gallery fall below zero (-3 deg. Cent.) as the outlet was approached. This, of course, caused some difficulty, the dynamite cartridges freezing in the drill holes.

The tunnel passes for the most part through hard gneiss, traversed here and there by layers of softer granite of a brownish color, where blasting proved more difficult. The soil was so compact as to require no propping. In order to facilitate ventilation and to accelerate the discharge of waste matter produced by blasting, a side gallery leading to the southeastern slope of the Mönch and terminating at a height of about 11,000 feet, was pierced at about 1.4 miles from Elsmeer Station. This gallery proved of great assistance in the construction of the last section of the tunnel, and as the piercing of the tunnel has just taken place at the appointed time, Jungfrauoch Station will be opened for public service in the course of the summer. This side gallery, with its entrancing panorama, gives a foretaste of the even more imposing one to be enjoyed from Jungfrauoch.

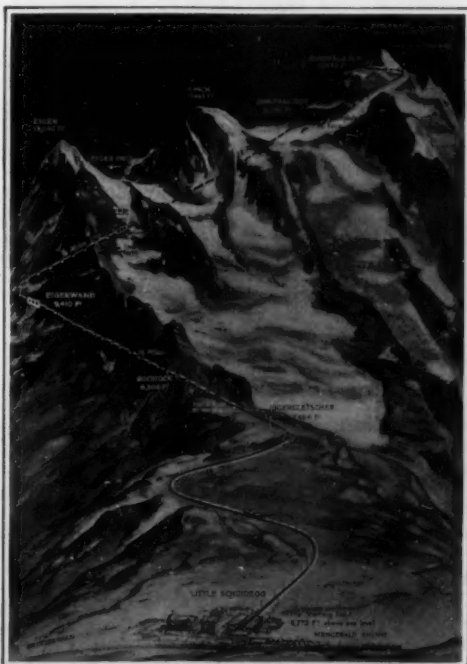
The work at the tunnel proceeded without any material hitch. True, the dynamite stores blew up on one occasion, and another time the workmen attempted to strike, but apart from this, there was no untoward incident, and the 200 men co-operating at so grandiose an undertaking seemed to be animated by a laudable feeling of solidarity.

Immediately behind the Mönch pit the tunnel assumes a steeper slope and by degrees, passes to a gradient of 25 per cent. In spite of its considerable length, the section from Elsmeer to Jungfrauoch will be covered in 18 minutes, the maximum speed allowed on Swiss adhesion lines being about 11 miles and on rack railways five miles per hour.

Jungfrauoch Station, being situated at 11,410 feet above sea level, lies at 4,620 feet above Kleine Scheidegg, the starting point of the railway. The tunnel there widens out into a vast platform whence a shaft 82½ feet in length will lead to a waiting room for several hundreds of travelers. The restaurant will be on the first floor, while the upper floor will contain a number of rooms for the staff as well as for belated tourists and persons desirous of spending a moonlit night in this surpassing mountain scenery. A gallery about 330 feet in length finally connects the station



The late Adolf Guyer-Zeller, who planned the Jungfrau railway.



Reproduced from a drawing by John Dunsen in the *Spectator*.

Course of the Jungfrau railway.

with an isolated rocky terrace, where pleasant walks and all sorts of winter sports, may be had in the midst of summer.

The station of Jungfrauoch, which is being installed at the upper end of the tunnel, lies between two mountain giants, the Jungfrau and Mönch, in a depression filled up by glaciers. It thus combines the contrasting views enjoyed from the two preceding stations (Eigerwand and Elsmeer), showing on the north side the green meadows and woods that clothe the lower mountains, as well as the vast plain of northern Switzerland, and, southward, the grandiose glaciers surrounded by a number of rocky ice peaks. Affording as it does a convenient starting point for the ascension of no less than six alpine summits more than 13,000 feet in height, this station must soon become an important tourists' center.

Elsmeer Station, which had so far been the terminal point of the Jungfrau line, is separated from the tunnel by a huge gate behind which a spacious machine shop had been installed. A discharge gallery communicating with the open air had been provided slightly farther on. The railway line thence continues for a distance of 1.85 miles in a straight line, on a slope of 6.3 per cent, as adhesion railway, passing immediately below the summit of the Mönch, the last 1,550 feet before Jungfrauoch Station being operated as rack railway, with a gradient of 25 per cent.

The last dynamite shot, fired on February 21st at 5:30 in the morning, accurately struck the calculated spot; at daybreak the miners made their way out through a hole three feet in diameter and with enthusiastic shouts of "Evviva" greeted the southern sky. The panorama unfolded before their eyes was wonderful, indeed the summit of the Jungfrau being in their immediate vicinity, surrounded by the glaciers of Aletsch and the Wallisian Alps. Though the thermometer was at 7 deg. Cent. below zero, the cold was hardly felt. The men stopped work for the rest of the day, and organized a simple banquet on the secluded Eiger glacier far from the madding crowd.

Smoke Abatement and the Steel Industry

THERE are, it seems, two sides to the smoke question. Coal smoke abatement exhibitions have been held recently at Sheffield and Glasgow, and one is to be opened March 23rd in the Royal Agricultural Hall, London, under the auspices of the Coal Smoke Abatement Society, which is carrying on an active propaganda against smoke in England. On the other hand, Prof. J. O. Arnold recently addressed the Sheffield Electro-Metallurgical Society in opposition to this movement, declaring that without smoke steel is impossible, as any operation that removes the carbon will produce poor steel; if a smokeless flame is used all the carbon is burned out and the surface of the metal is made rotten. The speaker declared that it is household smoke—usually ignored by the inspectors—that causes most injury to health. He also called attention to the singular fact that some medical men have lately recommended the smoky parts of Sheffield for sufferers from asthma.

The New Notions of Matter

By John W. N. Sullivan

AREPROACH which has often been leveled against science is that it tends to materialism. It is not difficult to see how this idea arose. Roughly speaking, we may say that the object of science is to explain all the phenomena of nature in terms of matter and motion. This statement is by no means sufficiently comprehensive, since the most modern work in physics is concerned to explain matter in terms of a much more subtle and elusive entity, electricity, but it will serve to characterize the general aim of scientific endeavor.

To many minds there is something repugnant in the very object of science. A well-known writer has asserted that his pleasure in observing a rainbow would be less if he knew the scientific explanation of its existence. And when one sinks into an apparently causeless condition of profound melancholy it is somewhat disconcerting to learn that it is not the mystery of the universe and of human life that is oppressing one, but that it is simply due to a temporary irregularity in the action of one's liver.

To some people the purely scientific outlook leaves no room for spontaneity and pure gladness. They feel themselves mercilessly bound by the chain of cause and effect.

Determinism is the philosophical outcome of scientific research. In materialism the spiritual is explained in terms of the material. Our loves and hates, desires and aspirations, reduce in the last analysis to peculiar motions of congeries of molecules. But supposing that all our emotions are found to be associated with definite molecular movements, is anything thereby explained? Tyndall asked this question in his Belfast address, and he was compelled to reply in the negative. The connection between motion and love for instance is, and must remain, utterly inexplicable. Motion and love are concepts which belong to entirely different classes, and they cannot be united in thought.

Materialism is in no better case than it ever was, and scientific research, however far it may be carried, can never, in the nature of the case, bring it any support.

Then in what sense can we say that science is materialistic? Only in the sense that science concerns itself mainly with the laws governing the phenomena manifested in the material universe. If we admit that psychology is a branch of science we see that science is not entirely concerned with the laws of mere matter. It also investigates the laws which govern human thought and human emotions. It has even penetrated into the realm of the occult, and the investigation of hypnotism and telepathy and kindred subjects shows that science is every day extending its range.

Science, then, is not purely materialistic in the subject of its investigations. Does it, then, always seek for a material explanation of the phenomena with which it concerns itself? Our answer to this question will depend on what we mean by the word "material." If by a material substance we mean what the old natural philosophers called "ponderable matter" we must reply in the negative. Modern physics is leading us even farther from the old idea of "matter" until now the atom, the old individual particle of matter, is regarded as a highly complex system of electrons, bodies whose mass is a variable quantity and wholly dependent upon their electrical properties and their velocities.

The mass of a material body used to be considered its most fundamental property. It never varied. But in the modern view the mass of a body is not only a variable quantity, but it is not a perfectly definite quantity at any instant! We may measure the mass of a body by seeing what velocity it acquires when we act upon it with a certain force for a certain time. But in the modern view this is not all. The velocity the body will acquire depends also on the direction in which we endeavor to move it. In scientific language an electron, the ultimate particle of matter, has a transverse and also a longitudinal mass.

If we take a body and charge it with electricity it will require a greater force to produce a given acceleration than when the body is uncharged. In other words, its apparent mass is increased by its electrical charge. This increase in mass will depend among other things on the quantity of electricity with which we charge the body.

Now, one of the most remarkable results obtained by modern scientific men is the fact that the apparent mass of a moving electron may be wholly accounted for by its electrical charge! There is no need to postulate the existence of ordinary matter at all. The presence of the electric charge accounts for everything. But this is not all. On the modern view all bodies are made up entirely of electrons—Isolated portions of electricity, as it were.

This remarkable discovery changes our whole view of matter. There is no longer matter in the sense in which we have hitherto understood it. There is nothing but electricity in motion. A further question naturally arises. And what is electricity? To this question

no very intelligible or satisfactory reply can be given. Some scientific men talk about "point discontinuities in the ether" which is not very illuminating until we know exactly what we mean by the ether. A modern school of great power denies the existence of the ether. In any case it is apparent that we have departed very largely from the notion of matter as used by the crude so-called "materialist."

To some people it seems that modern scientific concepts border very closely upon, if they do not actually invade, the realm of metaphysics.

We have said that the mass of an electron increased with its velocity. It increases in such a way that at the velocity of light the mass becomes infinite. In other words, motion at a speed greater than that of light is impossible in nature. This again is opposed to all our old ideas. Before this result was fully established an eminent German scientist worked out the dynamics of systems moving at a speed greater than that of light. On the modern view such systems could not exist in nature. We have here a result which many people find difficult of acceptance and to which objections at once present themselves. It is by pondering over these objections that scientific men have been led to enunciate the "Principle of Relativity."

This great principle is the most fundamental doctrine of modern physics. It asserts that mass, length, and time are all relative.

Let us take the notion of time as an example. Suppose we have two observers A and B at a certain distance apart. Let the system of which they form a part be at rest relative to some system of co-ordinates. A and B are each furnished with a clock and they wish to make their clocks synchronous. How will they do it? If an event occurs in the immediate neighborhood of A he can note the position occupied by the hands of his clock at that instant. Similarly B can note the time of the occurrence of an event in his neighborhood by observing his clock. But how can they arrange that the clock possessed by B shall mark the time of an event in the neighborhood of A and mark the same time as is marked by A's clock?

They may proceed in this way.

At a certain instant T, A flashes a signal to B. T₁ is the time marked by A's clock when he sends the signal. It is received by B when his clock marks a time T₂. He immediately flashes back a signal to A who receives it when his clock marks a time T₃. If now T₂ - T₁ = T₃ - T₂, i. e., if the differences in the times marked by the clocks are equal, then the two clocks are synchronous.

Suppose that A and B have their clocks adjusted in this manner. Now, without any other change, let the whole system move forward with a certain velocity in the direction of the line joining A and B. Consider an observer who does not take part in this motion, but remains fixed in his old position and who is observing the clocks of A and B. The differences in the times, if A and B continue to flash signals to one another, will no longer be equal to this observer. When A flashes his signal B is moving away from it, and when B flashes his signal A is moving toward it. Thus to the fixed observer it will take longer for the signal to travel from A to B than it will for the signal to travel from B to A. The clocks will no longer be synchronous to this observer.

It is by reasoning of this character that scientific men have arrived at the principle of relativity. Numerous experiments have shown that the velocity of light is not affected by the motion of the medium through which it passes. This fact is the basis of the modern theory. We have here a principle whose importance to modern science cannot be overestimated and which has philosophical relations of the utmost significance. It will be seen then that modern physics is by no means the dull and material subject it is considered by some imaginative writers, but that it deals with investigations of the greatest beauty and profundity and soars even to the height of metaphysical speculation itself.

Danger in Seltzer Water

ON account of the great increase in the use of carbonated waters, the safety of the containers from a hygienic point of view is coming to be a matter of general importance. Most of the "siphon" heads are made of lead or lead alloys. Dr. A. Barillé, a French chemist, has made an examination of the question of the relation of the composition of the siphon-heads to their effect upon the water, that is, to what extent the metals are dissolved. As the metals lead, tin and antimony may produce derangements of the digestive system, when introduced in small quantities, or may become accumulated within the body and in time produce more serious poisoning, these metals were especially studied.

It was found that a pure lead surface, or a pure tin surface, gives up much less metal to the carbonated water than does an alloy of the two metals. The reason for this lies in the fact that when the two metals are used together they set up electrical currents which

help in the further solution. At first an alloy of the two metals gives up the lead much more rapidly than the tin, but in the course of time the amounts are equalized, no matter what the proportions of the metals in the alloy may be. The amount of metal dissolved varied in quantity from six to sixty times the amount that is considered injurious by physiologists.

As a result of these investigations, Dr. Barillé recommends that carbonated waters be not kept in siphon-bottles too long before being used. A better plan would be to prohibit the use of bottles in which the water comes in contact with metallic surfaces. In Germany the heads of siphon bottles must not contain more than 1 per cent of lead, or must be made of pure tin with 10 per cent antimony.

The Technical Museum of Vienna

THE Technical Museum in Vienna publishes a circular stating that, in commemoration of the sixtieth anniversary of Emperor Francis Joseph's reign, Austrian manufacturers with the assistance of the State and the city of Vienna initiated this new museum. The foundation stone was laid on June 20th, 1909, and the building which covers an area over 20,000 square yards and which is situated opposite the palace of Schoenbrunn, is now nearing completion and will be a lasting monument of the monarch.

This Technical Museum is to demonstrate the development of industries and crafts in historical succession, also to do justice to the technical achievements of the present day, and to promote progress in this line by periodical exhibitions. It is to be a public educational center spreading the knowledge of the scientific foundations and the national-economic aims of technical pursuits.

A considerable stock of objects has already been secured. Several large and valuable State collections, till now dispersed, are to be brought together. But many links in the chain of technical development are still missing. Therefore, technical scientists, manufacturers and craftsmen of all countries are invited to co-operate in this great task and to assist the museum in procuring and selecting suitable objects. Everything pertaining to technical labor is acceptable, principally tools, machines, apparatus, models, materials, methods of working, finished articles, as well as plans, designs, books, illustrations and manuscripts. The Austrian government has donated the spacious halls of the Rotunde ("Prater") for the present storing and sifting of arriving donations. The names of donors will be perpetuated by inscription on the gifts and in a memorial book.

Further particulars can be obtained from the office of the Technical Museum, Vienna, I. Ebendorferstrasse 6.

Coins the Mint Buys and Sells

THE Mint does not buy old coins or paper money, except certain rare Colonial coins in fine condition, desired for the Mint's cabinet. Mutilated or uncurrent United States gold and silver coin is purchased as bullion. The Mint has no pattern pieces for sale; and the Government pays no premium for the return of any of its coins or paper money.

New coins cannot be struck in this country in the absence of authorization by Congress. The Mint supplies United States coins only and not of any past date. The \$50 goldpiece and the half-dollar and quarter-dollar pieces in gold were struck by private parties on the Pacific coast during the '49 period, and not by the Federal Government.

The coinage of the following coins ceased in the years named: The half-cent, copper, in 1857; one-cent, nickel, 1864; half-dime and three-cent, silver, and two-cent, bronze, in 1873; twenty-cent, silver, 1878; trade dollars, 1883; one-dollar and three-dollar, gold, and three-cent, nickel, 1889. The Columbian half-dollar was coined in 1892, and the Isabella quarter in 1893. The Lafayette dollar was struck in 1899, the date on the coin (1900) being that of the unveiling of the memorial.

Certain markings, indicating the place of coinage, are to be seen on our coins. Those struck at the Philadelphia Mint have no mint mark, but those struck at all other mints are distinguished by a small letter on the reverse, near the bottom. These letters are: "C" for Charlotte, N. C., discontinued in 1861; "CC" for Carson City, Nev., discontinued in 1893; "D" for Dahlonega, Ga., discontinued in 1861; "O" for New Orleans, and "S" for San Francisco.

The coins of the United States now authorized by law are: In gold, double eagle, eagle, half-eagle, quarter-eagle; in silver, half-dollar, quarter-dollar and dime; minor, five-cent, nickel, and one-cent, bronze.

Proof sets of both gold and silver coins are to be had by purchase from the Mint. When business there is slack medals may be struck from dies furnished by individuals, public institutions and incorporated societies, at a charge sufficient to cover the cost of the operation and the value of the metal.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Wright Brothers on the German Decision

To the Editor of the SCIENTIFIC AMERICAN:

We are in receipt of information from Germany regarding the recent action of the German Patent Office nullifying the main claim of the Wright German patent. A letter from our attorney says:

"After the discussion of all of these points, the division took one hour and a half to deliberate and then pronounced as their judgment that claim 1 should be annulled on the disclosure contained in *L'Aeronaut*, page 103, passage 5, in connection with *Automotor*, of February 15th, 1902, page 197, column 1, lines 2 to 4. The full grounds were not verbally pronounced. It was said that they would be given in writing."

The citation from *L'Aeronaut* is from a report of an address by Mr. Chanute before the Aero Club of France in April, 1903, describing the experiments of the Wright brothers at Kitty Hawk, N. C., in 1902. The citation from the *Automotor* is a synopsis of the address of Mr. Wilbur Wright before the Western Society of Engineers in 1901, describing the experiments at Kitty Hawk in 1901. The statement of Mr. Chanute which is cited as a disclosure of the Wright invention was as follows:

"To assure transverse equilibrium, the operator works two cords, which warp the right and left wings and at the same time adjust the vertical rear rudder."

Under the laws of Germany and France, a disclosure of an invention by the inventors, or by anyone else who has knowledge of it, before the application for a patent is filed, is sufficient to render the patent void. The disclosure must be sufficient to enable anyone to understand how to build and use the invention.

The German Patent Office has taken the extreme position that these few words were sufficient to teach anyone how to build and operate a flying machine in 1903, and that they canceled the right of the inventors to any property in their invention in Germany. The Wright brothers do not believe that this action of the Patent Office is based on a proper interpretation of the law, and will take an appeal to a higher tribunal.

The address of Mr. Chanute, on which the German decision turned, was delivered about two weeks after the date of the French application, and therefore could not be used against the Wrights in the French trial, which they won. The German application was not filed until after the date of this address by Mr. Chanute.

Dayton, Ohio.

WRIGHT BROTHERS.

The Kinemacolor Process

To the Editor of the SCIENTIFIC AMERICAN:

I much appreciate the article in which your contributor has dealt with our kinemacolor process. May I, however, be permitted to submit a correction? The article deals with the production of kinemacolor from one standpoint, namely, the selection and use of red and green light only.

This is not quite correct; it is well known that in order to produce natural color photography that shall be true to nature, it is necessary to make an exposure under three distinct screens—red, green, and blue. These three colors are taken as being the primary color sensations. Now, in kinematography, it is practically impossible, both mechanically and commercially, to take and reproduce a film that shall have three color sensations to produce one combined natural color effect. For this reason, a way out of the difficulty was found by reducing the three color sensations to two; now, if red and green alone were used, the blue would be totally neglected. In our kinemacolor results this is not so, as blue in every instance is recorded as blue. The loss of the third color sensation is compensated for in this way: The visible spectrum is divided into two portions at a given point, the total amount of color in each half being added together, which on the one side gives what may be termed red-orange, and on the other side blue-green. From this it may be noted that red-orange and blue-green being transmitted in suitable densities through the two screens a blue will be produced; but it may be argued that either screen will produce a given density of its own color only, and no other; it is found, however, in actual practice, that this is not so, as the density of a negative is considerably altered in recording either red or orange through the red-orange screen; likewise the blue-green sensations may also be considered from the same standpoint when recording blue or green. From these remarks it is easy to understand how a

full range of the visible spectrum may be reproduced from red to violet.

I further take this opportunity of pointing out that in recording a kinemacolor negative, daylight is naturally used, whereas in projecting the positive the electric arc is utilized; and as the latter is considerably richer in the blue violet than even sunlight itself, it is necessary to compensate for this by the use of suitable screens for the camera and the projector.

As may be imagined, enormous difficulties have had to be dealt with in the course of working kinemacolor. These are, however, being speedily overcome, so that the last picture taken is always the best, and our recent research in sensitizing, and the reorganization of filters and improvement of designs of cameras and projectors, are bound to place kinemacolor at the highest possible standard of efficiency that kinematography may ever hope to reach.

HENRY JOY, Consulting Engineer,
THE NATURAL COLOR KINEMATOGRAPH COMPANY, LTD.
London, England.

Henry vs. Dick. The Rotary Mimeograph Case

To the Editor of the SCIENTIFIC AMERICAN:

With sincere and profound respect for the great learning and ability of the Chief Justice of the Supreme Court of the United States, I beg, nevertheless, to ask the following questions, after careful study of the controlling and dissenting opinions announced in the Henry-Dick case:

Why is it that the public press generally assumed, as it clearly did, that the three dissenting justices must be right, and the four justices whose opinion control must be wrong?

Why is it that the Attorney-General, an official who would seem peculiarly in a position demanding that he accept the announced opinion of the court, assumes that the majority opinion is wrong, and seeks to have the case reheard and the decision reversed?

Is there any reason to assume that the three justices who join in the dissent are better versed in the law than the four who join in the controlling opinion? Certainly no one, lawyer or layman, can read the opinions without realizing that in the analysis and application of cited cases the logic and advantage are with the majority.

Apart from the strong leaning toward the side of States' rights, an ever fruitful point of controversy, and aside from the manifest fear that certain trust prosecutions will fail, which many believe never should have been begun, the dissenting opinion seems to rest upon a fear that at some future time some one may do things that certainly seem incredible, if not impossible.

The machine in question, a mimeograph or device for reproducing typewritten papers, was sold with this notice upon it (italics mine):

"This machine is sold by the A. B. Dick Co. with the license restriction that it may be used only with the stencil paper, ink and other supplies made by A. B. Dick Company, Chicago, U. S. A."

This seems clearly to show that it is the machine that is sold, and that it, the machine, may be used on the terms and conditions stated, that is, only with the specific ink, paper, etc. The restriction does not, and could not, control or limit the manufacture, sale, or use of ink for or to or by the general public. The public is free to make, and to buy, and to use, ink of any kind for any and every purpose for which it was free to make, to buy, or use ink prior to invention or existence of the mimeograph. The invention created a new field for ink. The inventor or his assigns had the exclusive right, by reason of his patent, to make, to use, and to vend to others to use, the patented machine or invention, with or without ink, paper, etc. He or they had the right to manufacture and to sell the machine, and to license or authorize the purchaser to use that machine, on any terms he or they saw fit, just as anyone may make sale of any property with condition that it shall be used only in a certain way or for a certain purpose, title to revert on breach of condition. The condition stated was that the machine might be used, but only with certain ink, stencil paper, etc. It was his or their privilege to forbid any use whatever of the machine during life of the patent. Of necessity, the greater right included the lesser one of forbidding use of the machine except in a certain way, or for a certain purpose, or with certain materials. The public could accept these terms, or decline them.

Judge Coxe, in the case of Tuttle et al. vs. Matthews, (28 Fed. Rep., 98) a case frequently cited by other courts with approval, expressly declared that: "The owner of a valid patent secures, by virtue thereof, three substantive rights: the right to make, the right to sell, and the right to use the patented article. He who invades any one of these rights is an infringer."

The United States Supreme Court has recognized

these distinct and separable rights, in the case of *Waterman vs. McKenzie*, 138 U. S., 252.

These three rights may be given a purchaser in one and the same document, or in a single transaction, or otherwise. It is well recognized, too, that if an absolute and unconditional sale of the patented machine be made, a sale without express reservation or condition, the right to use and to resell is implied. But in this Henry-Dick case the sale was coupled with the condition or license restriction, the whole constituting one single transaction, and leaving the full royalty or compensation to be paid through purchase of materials essential to use of the machine during its continuing use. If used in accordance with the license restriction, the license would protect the use. If used in violation of the license restriction, such use, not being contemplated or protected by the license, would be in infringement of the patent, just as use by anyone else without license would be.

The learned Chief Justice, in the dissenting opinion, says:

"Of course, as the owner of the machine possessed the ordinary right of an owner of property to use such materials as he pleased in operating his patented machine, and had the power in selling his machine to impose such conditions in the nature of covenants not contrary to public policy as he saw fit, I shall assume that he had the power to exact that the purchaser should use only a particular character of materials."

That is precisely what the owner and seller of the machine did do—exact that the purchaser should use the machine with only a particular character of materials, to wit, those made by A. B. Dick Co., and especially prepared for use with this machine.

Again the dissenting opinion says:

"But the result of this analysis serves at once again to establish, from another point of view, that the ruling now made in effect is that the patentee has the power, by contract, to extend his patent rights so as to bring within the claims of his patent things which were not embraced therein, thus virtually legislating by causing the patent laws to cover subjects to which without the exercise of the right of contract they could not reach, the result being not only to multiply monopolies at the will of an interested party, but also to destroy the jurisdiction of the State courts over subjects which from the beginning have been within their authority."

In what way is any monopoly created by the license restriction, which was the sole matter before the court? As expressly stated by Mr. Justice Lurton in the majority opinion:

"The stencil, the paper and the ink made by the patentee will continue to be unpatented. Any one will be as free to make, sell and use like articles as they would be without this restriction, save in one particular, namely, they may not be sold to a user of one of the patentee's machines with intent that they shall be used in violation of the license."

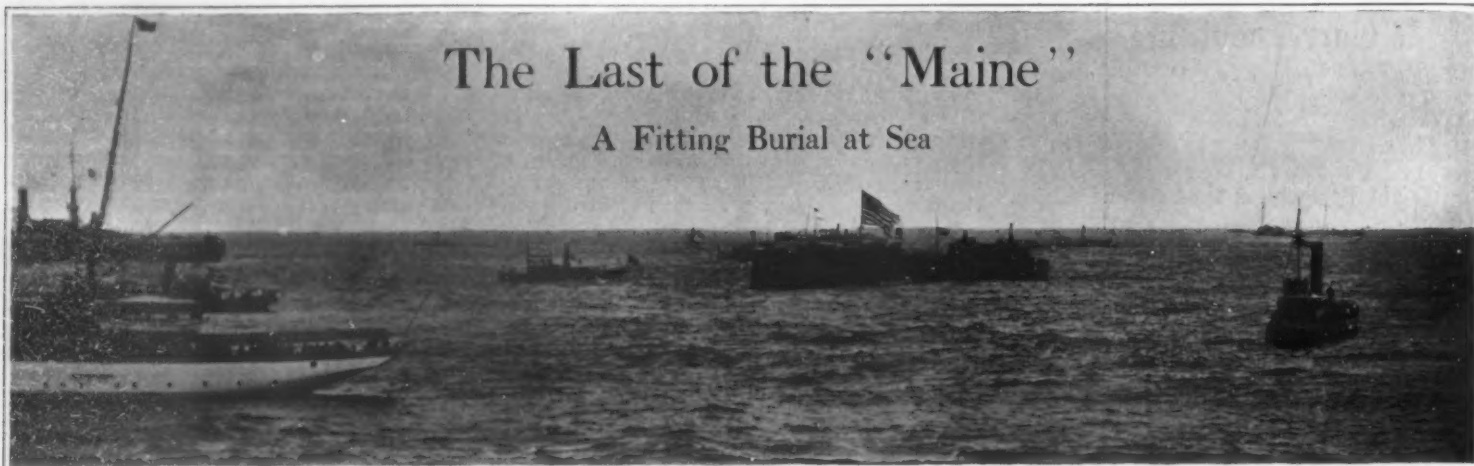
And again:

"The market for the sale of such articles to the users of his machine, which, by such a condition, he takes to himself, was a market which he alone created by the making and selling of a new invention. Had he kept his invention to himself, no ink could have been sold by others for use upon machines embodying that invention. By selling it subject to the restriction he took nothing from others and in no wise restricted their legitimate market."

The truth is, he broadened their market, presently and prospectively. Presently, by inciting other ingenious persons to devise other analogous machines requiring ink of similar character. Prospectively, by reason of the fact that when the patent on the machine expires, all ink makers may sell ink for use with the machine of the expired patent, in addition to all the uses previously existing and open to them. The restriction does not forbid the owner of the machine from buying and using the ink, paper, etc., as freely as he might otherwise do, for any and all purposes apart from the patented machine. It merely forbids use of the machine with or through the aid of those materials.

Whatever may be argued concerning jurisdiction, as to bringing within the contract persons not parties thereto, or as to conjectural future abuses, etc., one fact stands out clearly: The license restriction does not create, and the majority opinion does not sanction, any monopoly outside of or beyond that expressed in and by the claims of the patent on the machine. Anyone may make, use, and sell all the unpatented supplies, ink, paper, etc., to the same extent as before the patent issued, and when the patent expires, so that use of the machine can no longer be controlled thereby, there will be open to all this added field for the sale and use of such supplies for said machines. The supposed great evils to result from the decision are, I respectfully submit, greatly exaggerated, if not wholly imaginary.

A PATENT LAWYER.



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The Last of the "Maine"

A Fitting Burial at Sea

Scene just before the "Maine" went down for the last time.

THE first battleship of the new American Navy has been laid to rest with a ceremony that could not have been more solemn or impressive had it been paid to the memory of human life. The battleship "Maine," although it would now be classed as an armored cruiser, was the pride of the American Navy when, in 1890, it slid down the ways into the water at the Brooklyn navy yard. Eight years later this proud vessel was destroyed by treachery, and thereafter was allowed to rot, neglected, in the mud of a foreign harbor. "Every effort should be made to raise the 'Maine' and bring what remains of it to a home port," declared the SCIENTIFIC AMERICAN soon after the disaster. On March 16th, 1912, fourteen years later almost to the day, the wreck was towed out of Havana harbor with full naval honors and sunk in the waters of the Gulf Stream beyond the three-mile territorial limit.

At sunrise on the burial day a cannon shot boomed forth from Cabanas Fortress, and the shots were repeated every half hour thereafter, like the tolling of a bell, until the naval cortege was ready to start. Everything was ready for the ceremonial. We have told in these columns how the difficult work of raising the "Maine" was carried to a successful issue, and have explained that it was only the after part of the vessel that remained intact, the forward part having been reduced to a tangle of steel. This wreckage was cut into many pieces with the acetylene torch and hauled away, while a wooden bulkhead was built to close the gaping end of the remaining part of the "Maine." One of the dangers that was feared in the work of raising the "Maine" was the suction of the mud on the hull. To overcome this holes were bored through the bottom and the mud was loosened by means of jets of water forced therethrough. After the wreck had been raised successfully, sea-cocks were placed in these holes, near the bulkhead, to be opened when sinking the vessel. The bulkhead also was provided with five sluices, each about five feet high and a foot wide, ranging from side to side of the vessel, about two or three feet apart. This bulkhead formed the rear end of the hull, which was to be towed stern foremost.

It was at first proposed that the wreck should be destroyed by a blast of dynamite, but such an end to

the old ship seemed hardly fitting to the occasion. Furthermore, it held out danger to the spectators. On the other hand, if dependence were placed on the sea-cocks alone, some hitch might result, so that the time required to sink the vessel would run into hours. For this reason small charges of dynamite were provided for breaking up the bulkhead in case of an emergency. Fortunately no such emergency arose.

About nine o'clock on the morning of the burial day the battleship "North Carolina" and the scout cruiser "Birmingham" entered the harbor. An hour later the coffins containing those victims of the disaster that were not recovered until the "Maine" was raised, were borne upon the shoulders of Cuban artillerymen to the battleship "North Carolina." Sixty-six of the ill-fated crew were found in the wreck, and these have since been buried at the Arlington National Cemetery (on Saturday, March 23rd).

At 2:15 the signal was given for the start of the funeral procession, and as minute guns boomed from Cabanas Fortress the remains of the old battleship were towed out of the harbor by three tugs, one in the lead and two at either side, to hold it to its course. The American battleships fell in line and were followed by four Cuban gunboats. Dark clouds spread a pall over the sky, and a heavy swell disturbed the sea. At intervals of a mile the "North Carolina" fired signal guns. When about four miles from shore, the American vessels took position to the right of the wreck and the Cuban vessels to the left, while other ships ranged fore and aft to complete the square. A detail of sailors boarded the "Maine" and opened the sea-cocks. Very slowly the old hulk began to settle. The marine band played the National anthem. The bulkhead end was first submerged leaving above the water only the stern, from which flew an immense flag. Twenty minutes from the time the sea-cocks were opened, the decks gave way under the pressure of the air beneath them. As the setting sun broke through the clouds, the water closed over the "Maine" and its flag. Taps were sounded and then the sirens of the warships wailed a funeral dirge. Thousands of roses that had strewn the deck of the vessel floated on the surface of the sea, marking the grave of the old ship. The "North Carolina" and the "Birmingham" fired a parting salute, and

then proceeded on their way home with the bodies of the victims. Thus ended the most impressive funeral ever held at sea.

In the harbor of Havana there still remains the cofferdam with which the wreck was raised. This must be removed, together with the stone that was poured into the mud about the crib-work, when all traces of the tragedy will have been wiped away.

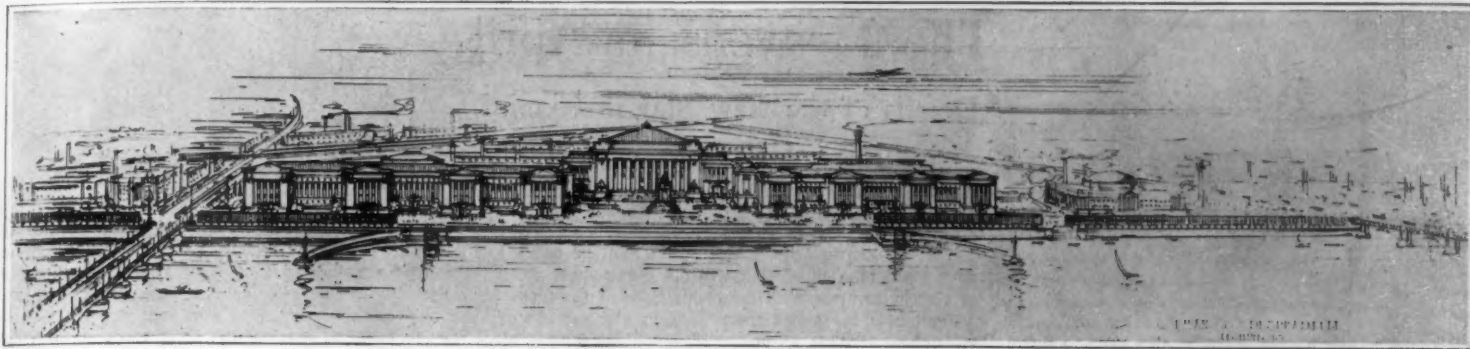
The Current Supplement

WE have become accustomed to unexpected new developments in science, but perhaps no more radical blow has ever been struck at our fundamental views than that which the principle of relativity aims at such seemingly firmly rooted concepts as those of time and space and mass. The reader of the current SUPPLEMENT will find an article by Prof. L. Mosbacher dealing with this subject.—We all remember the time when aluminium first became a common article of commerce. Since then it has found many fields of service; among the latest, which can hardly yet be said to have become firmly established, is that for fermenting and storage vessels in the brewing industry. C. Bleisch brings some important information on this subject.—The Paris correspondent of the SCIENTIFIC AMERICAN tells us of some of the most recent developments in microphotography as applied more particularly to metallurgy.—The Hovland system of printing telegraphy, which presents some features of special interest, is described in an illustrated article.—Carl Snyder's article on "Life Without Oxygen" is brought to conclusion in this issue.—Prof. L. R. Ingersoll, of the University of Wisconsin, has contributed to this number a most valuable paper on the "Optical Properties of Metals."—An important subject for the metallurgical engineer is "The Sintering and Briquetting of Flue-dust," discussed by F. A. Vogel.—The performance of model aeroplanes must have struck all who have seen it as perfectly amazing. The toy-aeroplane rights itself automatically, often after the most hazardous-looking plunge, therein excelling the full-size machines on a most essential point. A very excellent original article dealing in a strictly scientific manner with the design of model aeroplanes, is written for this issue by E. A. Vessey.



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Towing the remains of the old battleship out of Havana harbor.



Sketch of the Massachusetts Institute of Technology made by Prof. Despradelle.

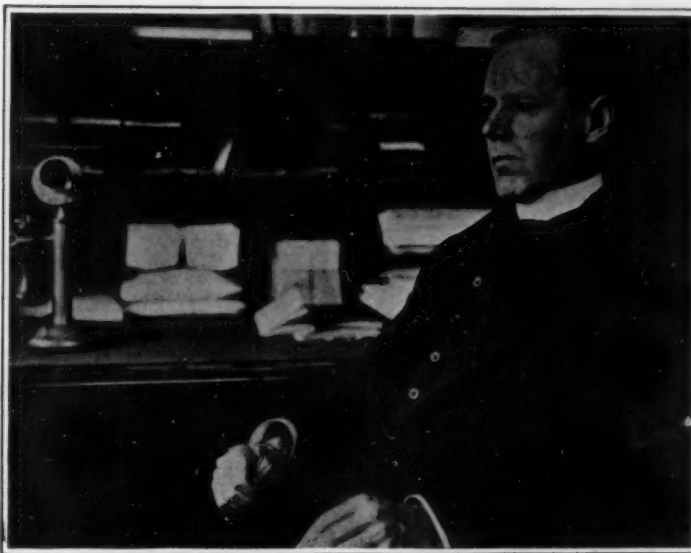
A Princely Gift for Technical Education

What the \$2,500,000 Donation to the Massachusetts Institute of Technology Means

By John Ritchie, Jr.

TWO and a half million dollars to the Institute of Technology from an anonymous giver is striking news in the educational world. This gift has a good many points of contact with modern business, and is important in bearing on education. In the first place it is refreshing to find someone who can give a large sum without feeling the necessity of widespread personal advertisement, and again it is interesting to see that this gift is subject practically to no conditions. It is to be used for the buildings of the New Technology, and is waiting to be called for at any moment.

In his address at the convention of students when he announced to them this splendid benefaction, Dr. MacLaurin said, "I am only just now beginning to realize its stupendous significance. It has made it possible for us to go ahead and plan the New Technology as a whole, and it will be built all together as one great unit. This I believe to be one of the greatest advantages of the gift, and it was distinctly the donor's intention that this should be made possible. The advantage of this over the usual method of construct-



By courtesy of the Boston Herald.

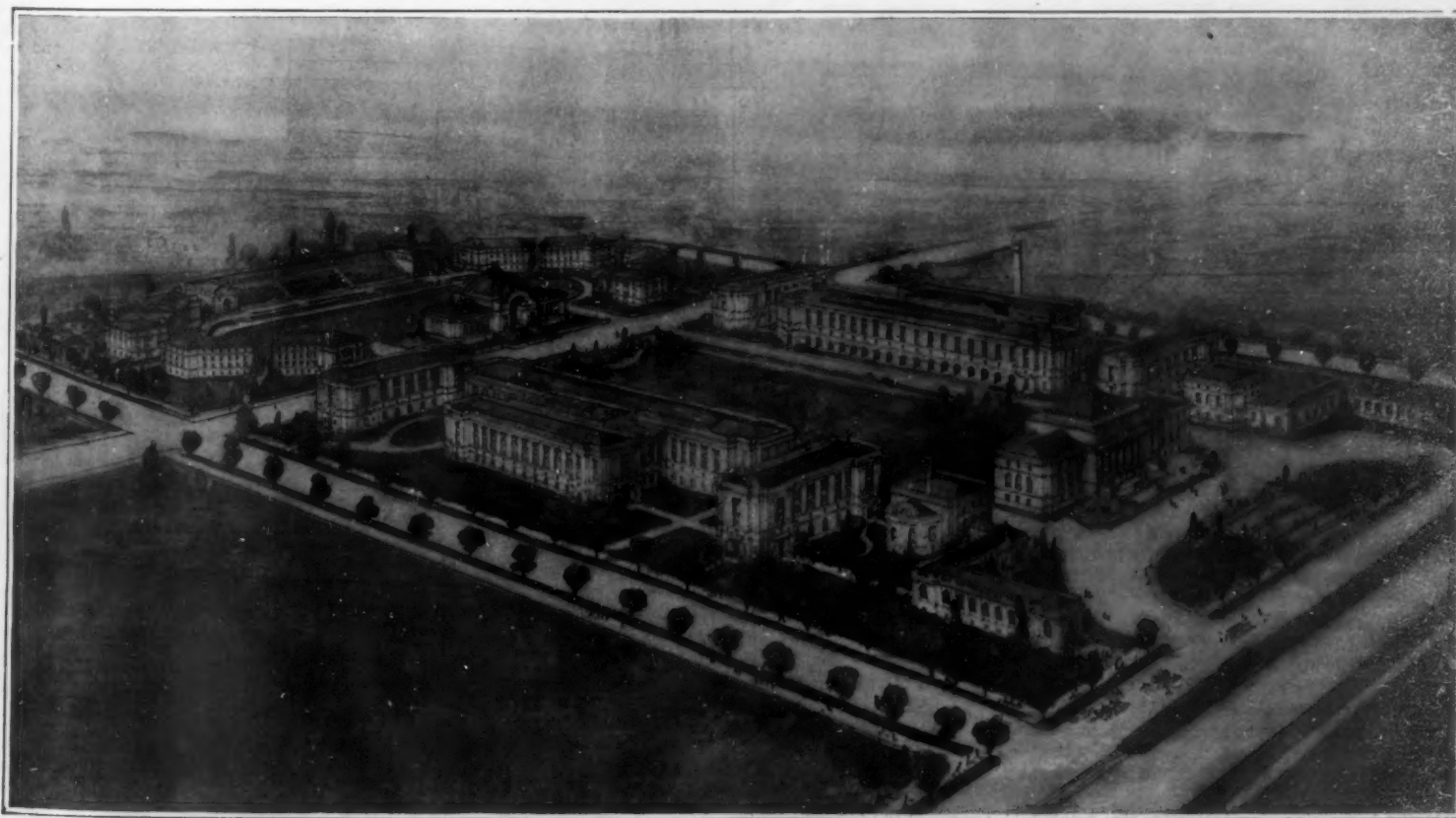
President MacLaurin of the Massachusetts Institute of Technology.

ing an institution's buildings one by one cannot be overestimated." The significance of the gift, entirely aside from the educational view point, is emphasis on the fact that this country can no longer be generally termed the "land of the almighty dollar." "There is no country in the world," said Dr. MacLaurin, "in which the wealthy contribute more for education, for art, and for philanthropy, and in a gift like this there is the strongest evidence that successful men in the business world are coming to realize the necessity to their enterprises of technical education."

To the Institute of Technology this gift means that the second of its great problems has been cleared away by a single man, just as the first of them, the purchase of its site, was solved by the half million dollar gift of T. C. du Pont.

With financial uncertainties in this particular out of the way, the Institute can now attack the problem of its new buildings, their arrangement and distribution as a single engineering problem, and will be able to erect on the Charles River em-

(Concluded on page 296.)



Suggestion for a Group of Technology Buildings made at a time when the inland location seemed possible.

A PRINCELY GIFT FOR TECHNICAL EDUCATION

The Heavens in April

Details of the New Star in Gemini

By Henry Norris Russell, Ph.D.



UR map this month shows, not the whole visible vault of heaven, but a smaller portion in more detail, covering the zodiacal region about Gemini and Cancer and extending well to the north and south. By preserving this and similar maps, which will be published at intervals, the reader will eventually find himself in possession of a star-atlas of considerable value. For the present we may content ourselves with calling attention to a few double stars and other objects of interest. β Monocerotis in R. A. 6 hours 24 minutes, declination 6 degrees 58 minutes south, is a fine triple, the wider pair being separated by 7.3 seconds and the closer by 2.7 seconds.

ζ Cancri (8 hours 6 minutes + 17 degrees 57 minutes) is another fine triple, the close pair, separated by a little over 1 second, being in orbital motion, with a period of about sixty years, and the companion 5 seconds away being in slow orbital revolution in the same direction.

ϵ Cancri (8 hours 41 minutes + 29 degrees 8 minutes) is a fine wide pair of magnitudes 4.2 and 6.6, separated by 30 seconds, and can be seen with the smallest telescopes.

α Leonis (at the edge of the map) has a companion of the 7th magnitude, nearly 3 minutes distant, which shares the proper motion of the brighter star, and hence must really be connected with it.

The following just outside the map are interesting: ζ Leonis has a companion 5 minutes distant, making a pretty pair in a field-glass. These two stars are moving in different directions, and have no real connection. ξ Ursae Majoris (11 hours 13 minutes + 32 degrees 6 minutes) is a fine binary system, of period sixty years, now separated by 1.7 seconds. γ Leonis and γ Virginis are also well-known systems, the latter having a separation (at present) of 6 seconds and a period of a little under 200 years, while the components of the former (separated by 3.7 seconds) must require more than a thousand years to complete one circuit about one another.

At our usual hour of observation (10:30 P. M. in the middle of the month) the region shown in our detailed map extends westward from the meridian almost to the western horizon. Outside it, we find Auriga, low in the northwest; Cassiopeia, due north and close to the horizon; Cepheus, just to the east of north; Lyra, rising in the northeast; Draco and Ursa Minor, well up on the right of the pole; and Ursa Major, almost overhead. Hercules, Corona and Boötes fill the eastern sky, and Ophiuchus and part of Scorpio are rising in the southeast, with Libra and Virgo above them.

The Planets.

Mercury is evening star until the 15th, when he passes between us and the sun, and becomes a morning star. He can only be seen just after dark at the beginning of the month, or just before daybreak at its close.

Venus is morning star in Pisces, rising about 4:45 A. M. in the middle of the month, and no longer as conspicuous as she was in the winter. On the 27th Venus and Mercury are in conjunction, the former being south of the latter.

Mars is evening star in Gemini, setting about midnight. On the 21st he passes within 20 minutes of the star ϵ Geminorum. This is a yellow star—somewhat more so than the sun—but it will probably appear green or blue by contrast with the ruddy light of the planet.

Jupiter is in the southern part of Ophiuchus and rises about 11:30 P. M. on the 1st and about 9:20 P. M. on the 30th.

Saturn is evening star in Aries, setting a little after 8 P. M. on the 1st. Before the end of the month he becomes practically invisible in the twilight.

Uranus is morning star in Capricornus. On the 23rd he is in quadrature with the sun, and crosses the meridian at 6 A. M.

America. The second, a solar eclipse on the 17th, is visible throughout the United States, east of the Mississippi, as a partial eclipse, the sun rising eclipsed, except for points east of New York, for which the eclipse begins just after sunrise. Only about one-third or one-fourth of the sun's southern edge is obscured, for observers in this country; but the eclipse is central along a long and very narrow track extending from British Guiana across the Atlantic past Madeira, across northern Spain, the Bay of Biscay, and the northern parts of France and Germany, far into Russia. Along most of this line the eclipse is annular; but for a small stretch in the middle (crossing Spain) it is total. The reason for this change is that the moon's shadow—

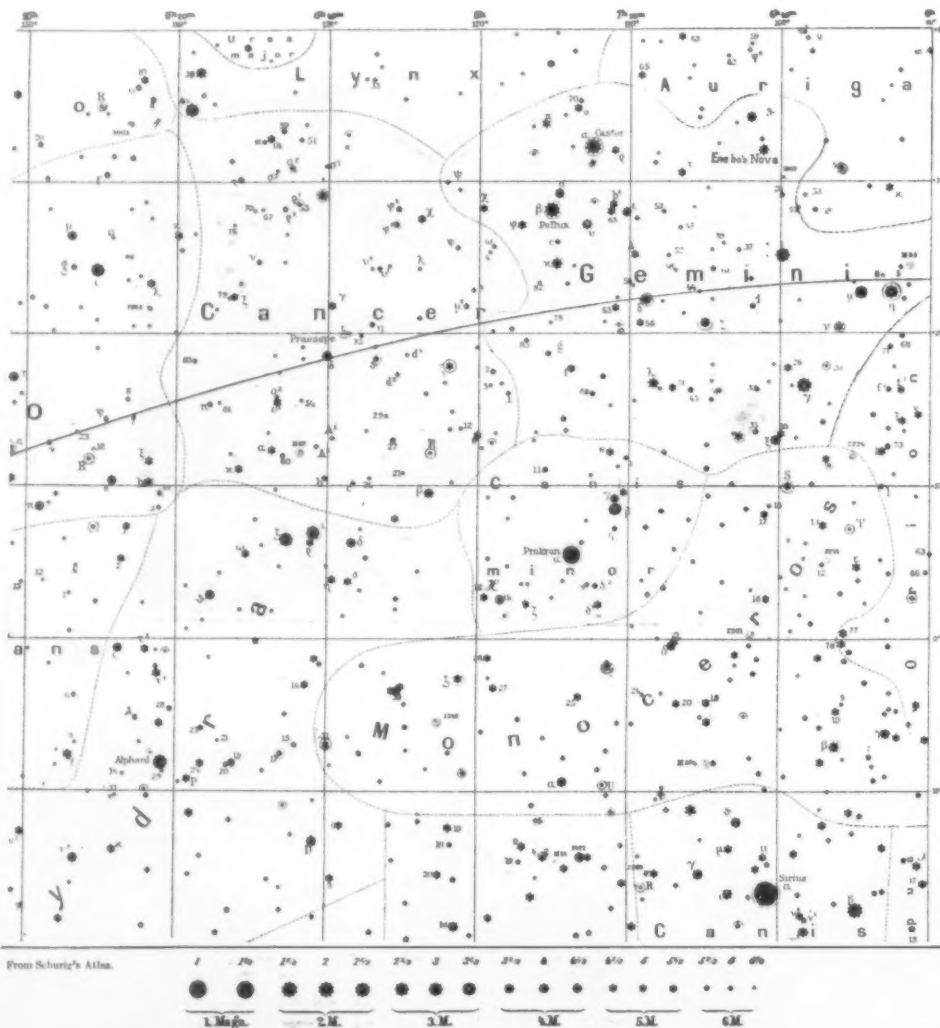
always a tapering cone—is in this case too short to reach the earth's center, but just long enough to touch that part of its surface which bulges out most toward the moon. The longest computed duration of totality is only one and six-tenths seconds, and the diameter of the shadow will at most be not more than a mile.

Observations will be carefully made of this eclipse, principally because by fixing accurately the track of this very narrow shadow, the relative positions of the sun and moon at the time of eclipse can be determined with extreme accuracy.

Enebo's Nova.

The telegraphic service, by which astronomical information of importance is distributed—on this side of the ocean from Harvard, and on the other from Kiel—brought word on March 13th of the discovery of a new star by Enebo, an assiduous Norwegian observer of variable stars. At the time of discovery it was of the fourth magnitude and was a fairly conspicuous object to the unaided eye. Photographs taken at Harvard show that on March 10th there was nothing as bright as the eleventh magnitude in the place of the Nova, while the next night it appeared of the fifth magnitude, having increased at least three hundred fold in brightness within twenty-four hours. The following night it was detected visually by Enebo,

who must have been very much on the alert. The Harvard photographs were taken in the course of their habitual charting of the sky, one of whose principal objects is to provide just such information as has been furnished in this case. On the 13th and 14th, the star was a little above the fourth magnitude, but by the 16th it had sunk almost to the fifth; and on the 18th to about magnitude 5.3. How bright it will be when this is printed is a matter of pure conjecture. Some new stars, such as that in Auriga in 1892, retained their original brightness, with irregular oscillations, for some weeks. Others, like that in Perseus, which appeared in 1901, faded steadily and rapidly till they had lost several magnitudes, and then more slowly. If the present Nova follows the first of these examples, it will still be visible to the naked eye early in April; but if the latter, it will already require telescopic aid to see it. Its position is indicated on the star-map which accompanies this article with sufficient accuracy for naked-eye identification, about two degrees south of the fourth-magnitude star θ Geminorum, which itself lies about 12 degrees east of Castor. For the use of observers with instrumental aid, the small sketch map



THE HEAVENS IN THE REGION OF CANCER AND GEMINI

Neptune is in Gemini, and is in quadrature with the sun, on the opposite side, on the 11th.

The moon is full at 4 P. M. on the 1st, in her last quarter at 9 A. M. on the 9th, new at 6 A. M. on the 17th, and in her first quarter at 3 A. M. on the 24th. She is nearest us on the 22nd, and farthest away on the 9th. In her circuit of the sky she passes near Jupiter on the 6th, Uranus on the 10th, Venus on the 15th, Mercury on the 16th, Saturn on the 19th, Mars on the 22nd, and Neptune on the 23rd. More interesting than these conjunctions (which are none of them close except that with Venus) is an occultation of the bright star Antares, which takes place on the 5th. As seen from Washington, the star disappears behind the moon's bright limb at 11:19 P. M. and comes out from behind the dark limb at 12:14. The times at other stations will be different from this, being in general earlier for points farther west and later for those farther east. The moon will be low in the southeast, even for observers in the eastern part of the country.

Two eclipses occur during this month. The first, a partial eclipse of the moon, on the 1st, is invisible in this country, but can be observed in Europe and Africa, and in part at least in large parts of Asia and South

(Concluded on page 296.)

The Laboratory

Some Suggestions for Home Experiment

Cheap Microscope Stands

By Claude C. Kiplinger

A SIMPLE and efficient microscope stand of the "Continental" type may be made as follows, without requiring any machine work or much of a financial outlay.

The base of the stand comprises a tin lid, obtained from a can or bucket, about 4 inches in diameter and $\frac{3}{8}$ inch deep, which is filled with lead, as follows: The lid should be heated over a fire and lead added from time to time, together with a little zinc chloride solution, until it is full of the melted metal. It should now be removed from the fire and allowed to cool. Before the lead solidifies, take a round wood stick $\frac{3}{4}$ inch in diameter, and, holding it vertically, make a depression or countersink in the center of the base. This should be about $\frac{1}{4}$ inch deep. At the middle of this countersink bore a $\frac{5}{16}$ -inch hole through the base, using an ordinary brace and a metal drill.

Procure a $\frac{1}{4}$ -inch bolt, $7\frac{1}{2}$ inches long, with two nuts to fit. Two pieces of heavy brass tubing $\frac{5}{16}$ inch internal diameter and $\frac{3}{4}$ inch external are cut to lengths of 2 and $2\frac{1}{2}$ inches, respectively. If tubing of this thickness cannot be obtained, thinner tubing of the same external diameter may be filled with melted lead or solder and cored with a $\frac{5}{16}$ -inch hole.

A rectangular brass or zinc plate 4 inches wide, $4\frac{1}{2}$ inches long, and $\frac{3}{16}$ inch thick should have a slot cut in one side 1 inch wide and $2\frac{1}{2}$ inches deep, as shown at A Fig. 2. A $\frac{5}{16}$ -inch hole should be drilled as shown at B. This forms the stage proper. A piece of brass or zinc bar $2\frac{1}{4}$ inches long, 2 inches wide, and $\frac{3}{4}$ inch thick should have a $\frac{5}{16}$ -inch hole bored through it lengthwise, as at S, Fig. 1. One edge of this block is grooved with a round file so as to fit a $\frac{1}{8}$ -inch brass tube, $\frac{1}{16}$ -inch gage, to which it should be soldered. (S and V, Fig. 1.)

The construction of the mirror fitting is shown in Fig. 3. At T is a bit of slotted brass tubing, of such internal diameter as to fit tightly over the tube X, Fig. 1. To this is soldered a screw N, Fig. 3, fitted with a thumb nut. A strip of brass $\frac{3}{8}$ inch wide and $\frac{1}{8}$ inch thick is bent as shown at D, Fig. 3, and holes are bored in each end. Another strip of the same width and thickness is bent and soldered so as to form a closed ring R. A screw with thumb nut is soldered to the outside of this tube, as shown at Y. Suitable screws and nuts may be obtained from worn-out dry cells. A bit of plane or concave mirror should be cut so as to fit the ring R tightly when pressed into position.

The parts of the stand proper may now be assembled, as illustrated in Fig. 1. The advantage of this form of construction lies in the great rigidity which can be obtained by putting the bolt L, Fig. 1, under a high tension. It is best to use two nuts and to tighten them as much as possible. This stand is sufficiently steady for all ordinary work.

No compound microscope is complete without a fine adjustment. The form to be described may be fitted to any instrument with a rectangular stage, and may be removed at will. Two pieces of $\frac{3}{32}$ -inch sheet brass 3 inches long and $2\frac{1}{4}$ inches wide are cut and bent so as to grip tightly the sides of the stage, as shown at E and F, Fig. 2. On one of the pieces, near each end, solder two brass points $\frac{1}{8}$ inch high (n and o, E, Fig. 2). To the other piece F solder a nut C, as shown. This nut should be fitted with a thumb screw $1\frac{1}{4}$ inches long (25 to 50 threads per inch), the tip of which should be conical.

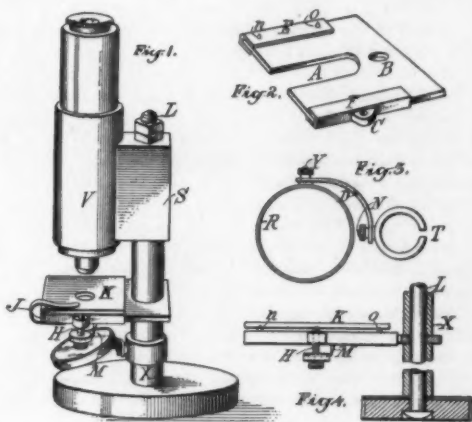
A rectangular brass plate $4\frac{1}{2}$ inches long, 3 inches wide, and $\frac{1}{8}$ inch thick should now be procured and a $\frac{1}{2}$ -inch hole bored at its center. Shallow depressions are to be punched in the plate to correspond with the points n and o, and the screw H, Fig. 1. A spring clip J, Fig. 1, holds the plate K in close contact with the three points. A graduated drum attached to the screw head and a pointer fastened as shown at M, Fig. 2, afford a means for estimating the amount of vertical movement of the plate. In Figs. 1 and 4 the stage is shown as assembled.

In a fine adjustment of this design, a certain amount of lateral movement of the image is unavoidable. However, this is partly compensated by the fact that there is absolutely no lost motion.

The brass work of the stand, with the exception of the stage, should be polished and given a coat of orange shellac varnish. The stage and base should be coated

with black bicycle enamel, or with a mixture of shellac varnish and lamp black. Objectives and eye-pieces may be obtained from any reputable optician. They should be mounted in brass tubes blackened inside. The tube V, Fig. 1, should be lined with cloth or felt, so that the body may slide in it without friction.

To conclude, this fine adjustment is superior to that form in which a flexible plate is employed, as described in "Experimental Science," seventeenth edition, page 282, because in the latter type it is im-



Home-made microscope stand.

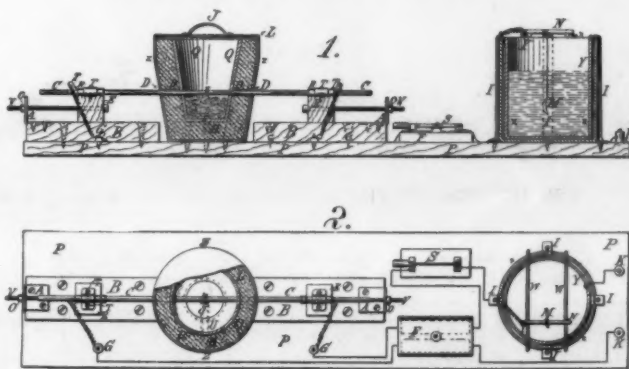
possible to turn the screw without slightly warping the superstage to one side or the other, especially if the screw has a rather long shank, as indeed it must have, in order to be comfortably and conveniently operated. It is hoped that these few and imperfect suggestions may bear fruit by adding new and enthusiastic devotees to the endless delights of microscopic research.

An Electric Furnace

By R. H. Crown

IN a laboratory or workshop the work often calls for the use of high temperatures. This article explains how to construct, at little cost and without much trouble, a small electric furnace which answers for general purposes.

The following are the chief articles necessary: A short piece of planking P, $32 \times 7 \times \frac{3}{4}$ inches; two pieces of board B, $7 \times 3 \times 1$ inches; two blocks of wood E, $1\frac{1}{2} \times 1\frac{1}{2} \times 1\frac{1}{4}$ inches; a small flower pot Z, $5\frac{1}{2}$ inches high, 4 inches in diameter at the bottom, and $5\frac{1}{2}$ inches in diameter at the top; a clay or earthenware crucible



Construction of an electric furnace.

Q, such as those used by chemists, $4\frac{1}{2}$ inches high, $2\frac{1}{2}$ inches wide at the bottom, and 4 inches wide at the top; three pounds of fire clay; one square foot of sheet asbestos, one-fourth inch thick; two iron bolts V, about $5\frac{1}{2}$ inches long and threaded for a distance of 3 inches; two nuts to fit the bolts; six binding posts; two small brass tubes R, $1\frac{1}{2}$ inches long and large enough to allow carbons to pass through them; a stone butter crock X, $5\frac{1}{2}$ inches high and 5 inches wide; a galvanized or tin cylinder Y, open at both ends and small enough to fit into jar X; two right angles shown at A in drawings; a switch S, and fuse box F; two carbons C.

The first thing to be done is to fasten the two short boards B to the planking P, as shown in drawings, leaving a space of about one-fourth inch between the end of the board and the planking, and a space of

$\frac{1}{4}$ inches between the two boards. Then place the fuse box and switch in position as shown at F and S in Fig. 2.

Drill holes for the carbons in the flower pot and crucible $2\frac{1}{2}$ inches from the plank. This must be done with care in order to get the holes accurately placed. Another hole H is also drilled half way between the first two points, but about an inch from the bottom, Fig. 1. If a crucible of the above size can be obtained, the starting point will be $1\frac{1}{4}$ inches from the bottom. These holes must be of sufficient size to allow carbons to pass through them. Another hole corresponding to the third one made in the flower pot must be drilled in the crucible to allow metal, etc., to run out. The flower pot should now be securely fastened by screws to the planking. Make sure that the two holes D for the carbons are in line with the boards B.

When this has been done the pot is partially filled with fire clay and the crucible is set in, so that a carbon may be passed through the four holes without any resistance. Be sure that the two holes H are in line with each other. Fill the space between the crucible and flower pot up to the top of the former, having first placed an insulator U such as is used to insulate the wires running through holes in a wall, through holes H so as to make a passage between the two. There should be a distance of about one-fourth inch between the top of the crucible and the pot. Allow the clay to set, meanwhile running the carbon backward and forward to keep the clay from sticking to it.

While the clay is drying, the carbon carriers, etc., can be constructed and the angle-pieces A placed. The angle-pieces, it may be briefly explained, are short strips of iron one-eighth inch thick, and $2\frac{1}{2}$ inches long, and $1\frac{1}{4}$ inches wide. These strips are bent at right angles in the center, two holes being drilled in one half, and one large hole (for the bolt) in the center of the other half. These can be made at any blacksmith's or machine shop for a few cents. The angle-pieces are centered at opposite ends of the two boards B after a seat has been chiseled for them so that they will not hinder the movement of the carbon-carriers. Then using the angle-pieces as guides the blocks E are bored to receive the bolts V.

The small brass tubes R are secured to the blocks E by means of straps of tin. Then the carbons are set in place. They should meet on the same straight line as shown in the drawings. Two binding-posts G are then fastened to the plank. To each of these a piece of lamp-wire is fastened and connections are made to the carbons by a strip of tin T, one-fourth inch wide and four inches long, doubled, the ends being forced between the carbons and brass tubes, and the doubled part fastened to the lamp-wire. Then a lid is made for the furnace out of the sheet-asbestos. A small wire handle is fastened on at J, as illustrated clearly in Fig. 1.

The next thing to be done is to construct the resistance. This can be made of iron wire wound around a brick. It is advisable, however, to follow the scheme described below, as a wire resistance gives off a great deal of heat and frequently blows out. The stone jar X is fastened to the plank P by strips of galvanized iron I hooked over the top. Inside the jar is placed the cylinder Y, leaving a space of about one-quarter inch between it and the inside of the jar. A small binding-post should be soldered to the top of the cylinder and also one to one of the strips I. Two strips of wood W are laid across the jar about $2\frac{1}{2}$ inches apart. On these is laid a large nail N from which is suspended a piece of metal M; the bowl of a spoon answers well. Connect the nail and the outside binding post as shown in the drawings. At this stage the two large binding-posts K

are screwed on and connections made, as in Fig. 2.

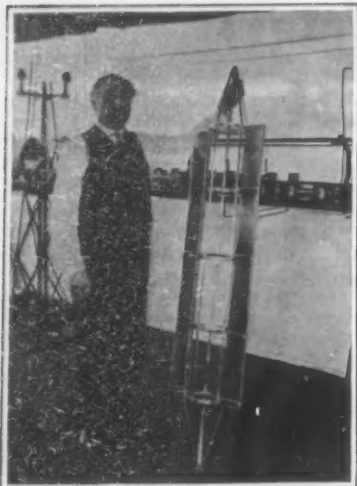
Now the furnace is ready for testing. A piece of six-ampere fuse wire is placed in fuse-box. Then the spoon is moved half-way between the center and the cylinder; and the jar is filled three-quarters full of boiling hot water. Now bring the carbons into contact and turn on the switch, drawing them apart by means of the nuts O. If the fuse stands the test, add a small quantity of salt and allow it to dissolve; then test again. Continue adding salt and testing until the fuse gives way. Now we have a resistance that allows just about six amperes to flow through it; then by moving the metal piece M nearer the cylinder the current is increased and by moving it toward the center the current is decreased. After placing a piece of seven-ampere fuse-wire in the fuse-box the furnace is completed.

What Inventors Are Doing

Simple Patent Law; Patent Office News; Inventions New and Interesting

The Floating Railroad Train

ON a perfectly level railroad the only work that the locomotive has to do, after getting under way, is to overcome the resistance produced by mechanical friction of the cars, as well as the friction of the air.



Mr. Bachelet and the skeleton aluminium car.

Except at enormously high speeds the greater item is the friction of the wheels and axles. In view of this inventors have attempted to overcome friction by floating the cars in the air.

A number of years ago we described an electro-magnetic railroad in which the cars were raised by magnets that pulled up against the under side of the rail, thereby relieving the car wheels of nearly all the load. Another even more novel scheme has just been patented. In this case use is made of Foucault or eddy currents to levitate the cars. Along the course of the road at frequent intervals electro-magnets are placed through which an alternating current is passed. The car is adapted to travel above the magnets and is arranged to energize only those magnets that are immediately adjacent to it. This is accomplished by providing brushes or shoes on the cars, which slide in channel rails at each side and above the car. The brushes also serve as guides to keep the car from sliding laterally out of the magnetic field. The car itself is formed of an iron cylinder mounted on an aluminium plate. When the magnets are energized the alternating magnetic field induces eddy currents in the aluminium plate, which, owing to their repulsion, lift the car from the magnets. The car thus supported in space is then propelled by means of solenoids which are successively energized to attract the iron body of the car and de-energized at the moment that the iron body reaches the neutral position within them. The effect of this mode of propulsion would be to accelerate the car to an enormous velocity, as there would be no resistance to overcome except that of the air and the slight resistance of the sliding brushes. Of course, at high speeds the air resistance would be considerable, but this could be reduced by providing the car with conical ends and a smooth cylindrical body.

While the project seems to be feasible one cannot help but feel that friction is bought off at an enormous cost, and when the actual power required for this purpose is estimated, the result is astonishing.

The inventor of this apparatus, Mr. Emil Bachelet, tells us that he can lift 12 pounds with an expenditure of 1 kilowatt. Let us compare his railroad with that of a level high-speed line such as those running from Philadelphia to Atlantic City. Here locomotives developing as much as

2,000 horse-power haul five-car passenger trains at speeds that run up to between 70 and 80 miles an hour. Of course Bachelet's railroad would not have to use heavy cars, but let us consider first the energy he would have to employ in lifting the passenger load only. Estimating fifty passengers to the car and 140 pounds to the passenger, we have a weight 35,000 pounds. As 1 kilowatt will lift 12 pounds we must use nearly 3,000 kilowatts or 4,000 horse-power merely to raise the load, without considering the weight of the cars or the air resistance, or their inertia. Even if the cars were reduced to a mere shell of iron with an aluminium base, the weight would have to be equal to as much as that of the load, and hence the cost of lifting the train without propelling it would be at least four times as great as that of propelling a loaded railway train, with cars weighing 80 tons each, at a speed of eighty miles an hour. This might not be too great a price to pay if enormous speeds were obtainable, but after floating the cars we still have air resistance to contend with, and as this varies as the square of speed, it soon foots up formidably.

No doubt some use will be made of Mr. Bachelet's work, although it may not now seem practicable for high-speed passenger transportation. He suggests mail or express carrying. Foucault currents have been very little studied, and some of the experiments that Mr. Bachelet performs with the "levitating coil" are not only astonishing but weird. In his model railroad he uses 60-cycle alternating current taken from the city main. To obtain greater efficiency in his levitating coil he uses an apparatus which he calls a "synchronized interrupter." Part of the current passes through an electro-magnet which operates on a vibrator that interrupts the circuit of the apparatus. A condenser is bridged across the terminals of the levitating coil. The alternating current passing through

the coil is interrupted at the peaks of the waves, and owing to the presence of the condenser superposed high frequency oscillations and a rapidly varying magnetic field are produced. With this arrangement the Foucault currents induced in the plate are much more intense, and result in much greater levitation.

After experimenting with all kinds of metals, Mr. Bachelet found that aluminium gave by far the best results. Brass and copper came next in the list and the other metals showed scarcely any effect. Projecting from the center of the coil is a pin which is adapted to pass through and to retain in place the plate placed on the coil. Using two superposed plates, the lower one of brass and the other of aluminium, Mr. Bachelet energized the coil and immediately the two plates were levitated, the brass plate rising to about half an inch above the coil and the aluminium plate $2\frac{1}{4}$ inches above the magnet. Each plate was $\frac{3}{8}$ of an inch thick. Mr. Bachelet finds that plates about $\frac{3}{8}$ to $\frac{1}{2}$ inch thick give the best results. While the plates remain in the levitated state they are heated by the electrical currents induced in them. In one sensational experiment a man held a sheet of asbestos in his hand, with a plate of aluminium resting on the asbestos, and then moved his hand into the field of the coil. In a short time the plate of aluminium became greatly heated, although the man through whose hand the lines of force passed felt nothing whatsoever. When the plate had been heated to a sufficiently high temperature an egg was broken open upon it and fried by the heat in the aluminium. Another striking experiment consisted in placing a flat-bottom glass bowl on the coil, filling it half full of water and placing some gold fish in the water. An aluminium plate was now introduced into the bowl and when the current was turned on this plate lifted itself up out of the water and floated

in the air half an inch above the water level. The sight was rather uncanny. One could take an aluminium plate, place it a few inches above the energized coil, pass his hands all around it without disturbing its poise, and find that it would resist a



C. Francis Jenkins.

downward push just as if it were upheld by a strong steel spring. Immediately the idea suggests itself that here is a valuable force for stage illusions and spiritualistic stances. Mr. Bachelet certainly deserves much credit for his original work.

A Professional Inventor

By William Atherton Du Puy

C. FRANCIS JENKINS is a professional inventor. For twenty years he has devoted himself to the business of inventing as other men dedicate themselves to banking, to law, to medicine or to journalism. He has met reverses, suffered hard times, known discouragement. Also he has tasted of the fruits of success. To-day he has enough of this world's goods to place him in circumstances which the generality would term affluent. The wolf never howls at his door. He labors only when he chooses, travels, dines, lounges. He reaps royalties where other men upon whom fortune has smiled, clip coupons.

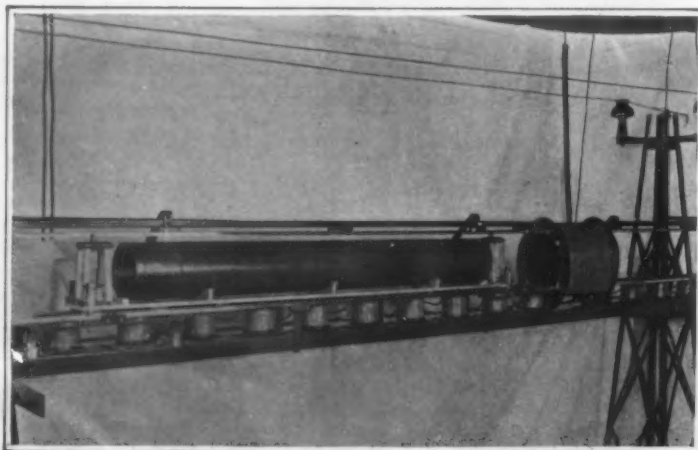
Mr. Jenkins, however, believes that his career is but just starting. He believes that in an apprenticeship of twenty years he has but just learned how to invent practically. He has just mastered the technique of the business in such a way as to enable him to reap greater profits in the future; for invention, he holds, is an art requiring that its devotees be born as poets and artists. It is a craft which requires a cleverness of the hands. At the same time it is a business that calls for a mastery of commercial affairs that makes the creative art and the craft practical. There is need of the visionary to see, the mechanic to put together and the business man to commercialize. Incidentally it is set forth that the qualities that would make a successful professional inventor are so rarely found that the species is almost unknown. The nation has but two or three to its credit to date.

C. Francis Jenkins was born an inventor. When he was a boy and lived on an Ohio farm he invented for fun, and there was not a machine on the place that was not fitted with his appliances. While still in his teens he made a machine that wove wire fence. It gained him a local reputation and a nearby manufacturer made a fortune out of it.

When Jenkins grew to maturity he escaped from the farm by learning stenography and entering the government service. From 1890 to 1894 he served the Federal Government in the capacity of stenographer in the Treasury Department



Riding on an electro-magnetic cushion. The aluminium side-plates of the car are floating $\frac{1}{2}$ inch above the magnets.



The steel car with aluminium base and one of the propelling solenoids.

in Washington. It was during these same years that he developed the invention upon which his fame chiefly hangs and which brought added pleasures into the lives of nearly all of our ninety millions. For C. Francis Jenkins is the inventor of the moving picture feature referred to below, and is the father of the moving picture show. The Franklin Institute of Philadelphia awarded him the Elliot Cresson gold medal for this invention.

It was in 1895 that Jenkins put on his first moving picture views. This entertainment was given at the Cotton States Show at Atlanta. In fact it was given in many localities in an attempt to make it popular. But moving pictures were a thing so new that newspaper advertising and write-ups were insufficient to attract the people. There was nothing of its kind in the world by which to measure it. To be understood it had to be seen. So Jenkins threw the doors of his show open to the public and asked no money until after the entertainments. So were the first audiences secured for those shows that are to-day amusing more people than any that the world has before known.

There had been attempts at perfecting the moving picture device before the time of Jenkins. Machines had been made and patented that were not unlike his. But they did not work. In his projecting machine he sought to secure more illumination. He wanted to hold the image on the screen as long as possible and make the time between pictures as short as possible. To secure this effect he merely made a larger hole in certain of his shutters. Upon this basis the projecting machine worked. It was the same projecting machine that is used in all the moving picture shows to-day.

When Jenkins went to the Patent Office with his device he was at first refused a patent. It was argued that his machine was no different from others that had gone before. The examiners said that it was merely different as to degree and not as to principle. Jenkins argued that it was different in this—it would work and the others would not. In the end he was granted a patent for a shutter with a bigger hole in it than those that had gone before. Yet that patent has stood the test of a decade of attack and still holds. It was the real basis of the development of the moving picture machines of to-day and there is no assurance that there would be one of these shows in your block and mine if it had not been for C. Francis Jenkins.

Jenkins sold his moving picture inventions for a few thousand dollars. He needed the money, for he had tasted of success in the field of invention and decided that he would nail his colors to the mast of the ship of practical creativeness and keep them there to the end of the chapter. So he gave up his government clerkship and went into the business of inventing. That was sixteen years ago and he has done nothing but invent since.

The first few years of his career in his chosen profession were little different from the first few years in almost any profession. They were made up chiefly of expectation, disappointment and hard times. He had not the practical knowledge of the manner of making practical inventions and deriving money profits from them. His inventions of that period were numbered by the score but the returns from them were so small that his profits on the moving picture machines were soon all squandered. He met one disappointment after another until he was finally driven to the last extreme. One night he came home and talked their desperate straits over with his wife. She advised him to take a position with a Philadelphia firm where his mechanical skill would bring him a mechanic's wages. He begged her to give him one month more. He pledged to her and to himself that if he had not made good within that month he would give up inventing forever.

Before the end of that month he had sold some of his patents for a few hundred dollars. Sales were fairly regular from that day forward and hard times were gone for good. The professional's starving period was passed.

It was in 1898 that Jenkins patented a

paper bottle as a container for milk and such liquids. The idea was to use the bottle but the once and to throw it away. It had to be produced very cheaply to make this scheme cheaper than washing glass bottles. The bottles were placed on the market and used to a certain extent. They never, however, came into general use. No great amount of money was ever made from them. But in his attempt to get them on the market at a competing price Jenkins invented machinery for their manufacture that was of great commercial value. This machinery meant a great economy in the manufacture of various sorts of paper boxes that were already in use. While failing to make money on the bottles Jenkins made his first big profits on this machinery. In fact the machinery is still a source of revenue on a large scale.

In the past fifteen years Jenkins has turned out several hundred inventions. Many of these have been small things. In a great number of instances they have been but improvements on the inefficient efforts of other inventors. Often they have been but differences in degree and the Patent Office has protested against their use. One of the latest of such inventions is an automatic starter for automobiles which, it is promised, will be on next year's models of most of the automobiles made. Everybody realizes that there is a need of an effective starter for heavy automobiles that will do away with the necessity of cranking. These starters were already effective on light machines. Some had been used on heavier machines but were ineffective. Jenkins perfected these, improved them, made a complete, workable starter. His appliance was not greatly different in principle from some that had gone before but it had the vital quality of working. Being a practical inventor he made one of these starters that was of attractive appearance when attached to a car, placed it on his own machine and drove to the office of the biggest man in the automobile business. He demonstrated to this man and his engineers that the starter worked. He knew the importance and value of his patent. He was in a position to demand its value. He knew his business as an inventor.

Mr. Jenkins believes that he has invented an engine that will revolutionize the business of automobile building. He has patented the engine and his patents are declared basic. Yet the patents rest merely upon the moving of a spark plug from one place to another, just as Alexander Graham Bell's invention of the telephone depended on turning a screw one-fourth of one revolution.

The mind of Jenkins is interesting in that it is the mind of the practical, working inventor. His attention, for instance, was recently called to a folding umbrella such as has been on the market for several years without gaining any great popularity. His mental attitude toward this umbrella was that it was not the solution of the problem. It did not work as it should. The matter bothered him for weeks. His mind was instinctively seeking the solution. In the end he made an umbrella in three joints, each of which slides inside the other. This he patented. It may be the solution, but unless it works in a satisfactory way the inventor's mind will continue its gropings.

So, believes Jenkins, does the mind of the instinctive inventor work day and night with the problem of things that are not yet fixed right. Such has been the course of his own mind in working out a solution of some hundreds of practical inventions. Such is probably the course of every inventive mind and the result of this taking thought depends upon the correctness and practicality of the mind in question. Likewise the progress of the world has much to do with the findings of these minds with the power to create the new and apply it to the needs of man.

Notes for Inventors

Safety for Washington Elevator Passengers.—The Hon. Mr. Labeck of Nebraska has introduced in the House of Representatives a bill providing that no passenger elevator shall be installed or operated in the

District of Columbia unless equipped with an automatic device approved by the Commissioners of the District of Columbia, which device will prevent the elevator car from being moved in either direction while any gate, door or doors for exits or entry are open or unclosed. It also provides for the installation of the safety equipment on cars now in use and makes violation of the act a misdemeanor and subject to a fine of twenty-five dollars for each day or part of a day it is violated.

A Fountain-pen with Windows.—Every fountain-pen user has experienced the annoyance of finding that his ink has run out without warning. And against his will he must stop and refill his pen before he can proceed with his work. A New York fountain-pen manufacturer has hit upon a very ingenious method of avoiding that annoyance. He provides his fountain pens with little windows, two in the smaller size and three in the larger. These indicate exactly the quantity of ink in the pen. The windows are as thick as the wall of the ink cylinder and cannot possibly break. They invariably are clear and white whenever the ink is below their level. Even when the pen is nearly full the amount of ink contained in it can be ascertained by tilting the pen from side to side and watching the ink seek its level through the windows.

Canning the Baby.—A novel baby holder is shown in a patent recently issued at Washington to a resident of Evanston, Ill. It is a cylindrical can of sheet metal, having a side door through which the baby may be placed into and removed from the can. At the top is a lid, so the baby's head may stick out of the upper end of the can when the baby is standing up or sitting down, an adjustable seat being provided on which the baby may be seated. The can is pivoted near one end to a suitable support, so it may hang vertically when the baby is sitting or standing; or the can may be arranged horizontally and so held by a strap, in order that the baby may lie prone to sleep. Perforations are provided to afford the infant necessary air. That the designer does not intend the "can" for home use only, is evidenced by his adapting it for adjustment to any standing structure, including the back of a seat in a railway car.

Legal Notes

Some Adjudicated Patents.—In *Century Electric Company v. Westinghouse Electric and Manufacturing Company*, 191, Fed. Rep., 350 claim 1 of the Tesla patent, No. 511,559; claim 1 of the Tesla patent, No. 511,915, and claims 1, 2 and 6 of the Tesla patent, No. 555,190, were held valid and infringed; in *Tabor Manufacturing Company v. E. H. Mumford Company*, 191, Fed. Rep., 166; the Tabor and Mumford patent, No. 582,325, the Tabor patent, No. 533,401, and the Tabor and Mumford patent, No. 654,292, for molding machinery were construed and held not infringed; in *Greer v. Heinz-Wandner X-Ray Tube Company*, 191, Fed. Rep., 201; the Sayen patent, No. 594,036, for improvement in high-vacuum, or Roentgen-ray tubes claims 2 and 3 held infringed on a motion for preliminary injunction; in *E. H. Freeman Electric Company v. General Electric Company*, 191, Fed. Rep., 168; the Sargent patent, No. 665,582, was construed and held valid and infringed.

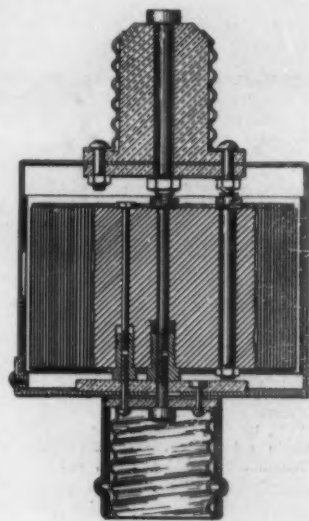
Actions by Poor Persons in the Patent Office.—In *re Meta Mattulath*, administratrix of Hugo Mattulath, deceased, the Court of Appeals of the District of Columbia, in holding that the Patent Office is not, and cannot be converted into a court of the United States, has decided that the Act of Congress of June 25th, 1910, allowing the prosecution or defense of suits or actions in the courts of the United States and appeals to the Circuit Court of Appeals and to the Supreme Court of the United States in *forma pauperis* upon certain conditions therein prescribed is not applicable to appeals from the decisions of the Commissioner of Patents to the Court of Appeals of the District of Columbia, since such an appeal is not in a suit or action and the Patent Office is not a court of the United States.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Electrical Devices.

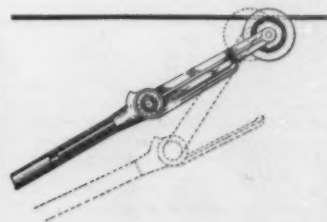
VOLTAGE REDUCER.—W. A. HERSE, 1015 Santa Clara Avenue, Alameda, Cal., and J. T. SLAVEN, Oakland, Cal. In this patent the invention has reference to voltage reducers working upon the principle of reducing the voltage by the introduction of resistance. The voltage reducer may be employed in any num-



VOLTAGE REDUCER.

ber of different relations. It is especially adapted for use in connection with incandescent lamp sockets. It may be employed, for instance, to enable the use of low voltage tungsten lamps in a circuit normally affording high voltage. It is also of peculiar adaptability for use in connection with fan motors and with "dental engines," as well as in connection with various types of electric motors used in various arts. The engraving shows a substantially central section through one of the resistance units of which the reducer is made up.

TROLLEY RETAINER.—A. H. FLETCHER, New Brighton, Richmond, New York, N. Y. The more particular purpose in this invention is to provide an improved device suitable for use upon trolleys generally, but especially adapted for overhead trolleys of the type suitable for passing under low bridges, through tunnels and in similar relations. It compre-



TROLLEY RETAINER.

hends a trolley pole provided with an arm movable relatively to the pole and carrying a trolley harp in which the contact wheel is mounted. It further comprehends an improved housing for the spring mechanism used for raising the arm and normally pressing it constantly against the under side of the conductor which supplies the current. The side elevation in the engraving shows in full lines the retainer and indicating by dotted lines the relative movements of various parts while in use.

Of Interest to Farmers.

BLADE HARROW.—C. L. WALK, Lawrence, Kan. An object here is to provide a harrow which is inexpensive to manufacture and will not readily wear out, by means of which the ground can be thoroughly prepared for planting, which can be used in cultivating, for example, in cultivating listed corn, and which will suitably level the ground and break up clods or lumps of earth.

COTTON GIN BRUSH.—S. F. KRUPP, care of Continental Gin Company, Atlanta, Ga. The improvement relates particularly to brushes which in cotton gins are brought into contact with the periphery of the saw cylinder for removing lint cotton therefrom and discharging it from the machine. It provides a durable rotary brush constructed of interchangeable parts, which will readily permit of repairs being made, the brush being so constructed that it will preserve its running balance.

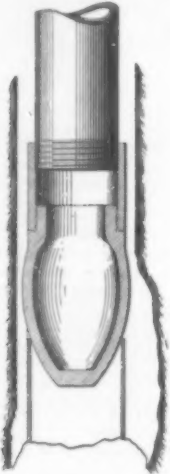
STAMP.—O. FERGUSON, Porter, Minn. Mr. Ferguson's invention relates more particularly to egg stamps, the purpose being to provide a stamp so constructed and arranged that it will fit in the hands of the user and as the latter picks up an egg and brings it in contact with the stamp on the palm of the hand, it will make an impression upon the egg to indicate when the egg was gathered or marketed.

FRUIT PICKER.—S. M. WORE, Indiana, Pa. This picker is easily manipulated and arranged to permit of picking apples, pears and other fruits without danger of bruising the same, to allow lowering of the picked fruit without requiring the operator to lower the pole, and to permit of readily reaching the fruit at different heights without changing the position of the pole.

CHURN.—C. L. WALL, Strasburger, Neb. This churn may be conveniently taken apart to permit of the cleaning of the parts, a draining cup being attached to the lid for closing the body of the churn, by which the butter may be readily removed from the buttermilk. Means provide by which the body of the churn, with its lid, may be firmly secured in a cage having trunnions journaled in bearings in the frame.

Of General Interest.

OFFSET SHOE AND CAST IRON OFFSET SHOE GUIDE.—A. C. GRAHAM, care of California Oilfields, Ltd., Oilfields, Cal. This invention relates to means for connecting the casings used in well construction. In the construction of wells, particularly through soil of different strata, it frequently happens especially in long casings, that the latter buckle at certain points in the construction where the surrounding ground is weak, and frequent-

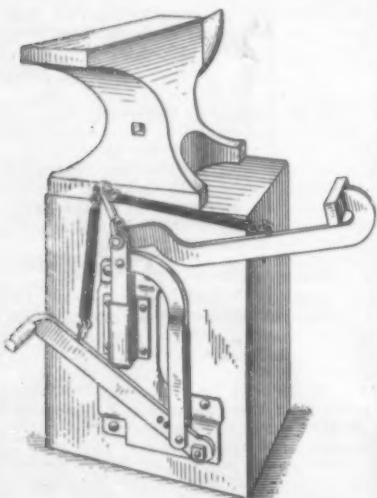


OFFSET SHOE AND CAST IRON OFFSET SHOE GUIDE.

ly the casing is broken off and it is difficult to raise the broken part or to drain it out, so as to attach another casing thereto. To overcome these difficulties, a means is provided which may be inserted into the end of the broken-off casing, and which will afford means to enable the constructor to attach another section thereto. This is attained by attaching a shoe to the end of a pipe, the shoe having means to grip the broken-off pipe, to afford means to fasten a superposed casing upon the broken-off section. A sectional view is shown of the lower end of this finding tool and connection.

Hardware and Tools.

VICE.—T. T. MERRIMAN and B. F. PRATT, Central Point, Ore. This invention provides



VICE.

a vise attachable to the anvil block or pedestal and operable in conjunction with the anvil; provides an operating mechanism for the movable jaw which automatically adjusts the clamping member thereof in operative relation to the anvil; and provides a mechanism simple, durable and readily adjusted to the anvil block of ordinary construction. The vise shown in the accompanying engraving is employed principally in the operation known as hot rasping. The view shows in perspective an anvil and block therefor provided with a vise constructed and arranged in accordance with the present invention.

FOLDING SQUARE.—J. O. OSTMAN, 1008 Minnesota Avenue, Hancock, Mich. In this instance the object of the inventor is the provision of a simple and easily operated folding square device consisting of sections which may be folded on each other, or extended in operative position, and which may be securely locked in either position.

Heating and Lighting.

MEANS FOR INDICATING THE PRODUCTION OF GAS.—HUGO STRACHE, Vienna, Austria-Hungary. This invention provides an instrument which when connected to gas-producing apparatus visibly indicates the quantity of gas formed per unit of time. This plays an important part, particularly when generating water gas, since from the quantity formed per unit of time with constant velocity of the steam introduced into the producer, the perfection of the decomposition of the steam may be known.

FURNACE.—N. FROST, care of The American Foundry and Furnace Company, Bloomington, Ill. In this instance the invention relates to improvements in furnaces for use in heating air and relates more particularly to a furnace in which the air is exhausted to flow backwardly through conduits or passageways before being delivered to the smokestack.

INCANDESCENT GAS AND LIKE BURNER.—J. GALILE, 1 bis Rue de la Visitation, Nancy, Meurthe-et-Moselle, France. This invention has for its object an incandescent gas burner, whereby, with but a small gas consumption, to obtain illumination sufficient for the purpose of a night-light from the incandescence of a disk of gauze impregnated with rare oxides submitted to the action of the flame from an atmospheric burner.

GRATE.—T. V. ELLIOTT, Flatbush, New York, N. Y. The intention here is to provide a grate more especially designed for furnaces using pulverized coal or a like reduced material as a fuel, and arranged to provide a continuous inclined bed for the fuel to rest on, to admit air for proper combustion, and to allow rocking of the grate bars for actuating the fuel and causing it to gradually slip down and off the lower end of the inclined bed.

Machines and Mechanical Devices.

MULTIPLEX SHUTTLE EMBROIDERING MACHINE.—J. KAUSI, 725 Broadway, New York, N. Y. The object here is to so construct an embroidering machine that a plurality of fabrics in the same and different planes can be simultaneously embroidered from a single pattern. Further, the object is to so position the separate fabrics, in preferably staggered relation, so that access may be had to any of the fabrics without removing the operating mechanism, and without disturbing the other fabrics.

SHUTTLE EMBROIDERING MACHINE.—J. KAUSI, 725 Broadway, New York, N. Y. This invention relates to a machine which is adapted to embroider on a plurality of strips of fabric simultaneously. While possible in the past to embroider on two separate strips of fabric, no machine has been found which is practical that will embroider a greater number of strips of fabric than two with any degree of success. One of the objects, therefore, is to provide a device which will embroider not only a plurality of strips of fabric in the same vertical plane, but also a plurality of strips of fabric in different vertical planes.

CUTTING OUT AND MOLDING MACHINE.—E. L. FOURTAUBORDE, 13 Rue du Faubourg Montmartre, Paris, France. The present invention has reference to a machine for molding and cutting out, according to certain patterns or models, objects of any desired shape, such as countersinks, granite walls or stones, by means of rotating steel tools. The machine may be used for working materials of all kinds, but is especially adapted to hard substances, such as marble, onyx, granite and the like.

SMOKING DEVICE.—H. E. COATES, 1111½ Eye Street, Sacramento, Cal. The object of this invention is to provide a new and improved smoking device, more especially designed for use as an advertising medium in cigar stores and other places, and arranged to simulate a person in the act of smoking a cigar, cigarette, pipe or other smokers' article. By use of actuating mechanism, means are employed to express contrast between qualities of a good and a bad cigar.

HEMP BREAK.—F. O'NEILL, Jr., Paris Ky. This inventor provides a break arranged to subject the material successively to the

action of breaking mechanisms, to break the woody portion into small pieces, to separate the same from the fibers, to discharge the fibers from the machine in marketable condition and to gather the broken pieces and the dust and discharge the same from the machine separate from the fibers.

CUT-OFF.—J. B. PRUDEN, Quanah, Tex. The aim here is to control the supply of water discharged from a roof so that a given amount of it may be conducted to a sewer or other off-take until the roof has been washed, and the balance of the water be deflected into a cistern or other reservoir.

EMBROIDERY PRINTING MACHINE.—R. WALSER, 520 Walnut St., W. Hoboken, N. J. This improvement relates to machines for printing ornamental patterns, designs or the like, upon embroidered fabrics or similar materials, and refers more particularly to a machine which comprises printing means for producing designs or patterns, preferably in colors, feeding mechanism for advancing the fabric into operative relationship with the printing means and the feeding mechanism.

SAND-DRYING FURNACE.—F. W. ADLOF, Box 718, New Kensington, Pa. In this instance the invention has reference to a new and improved form of sand-drying machine, and an object of the inventor is to supply the wet or damp sand in thin streams through the furnace in such a manner that the separate particles will be exposed to the direct heat of the furnace.

WHEELED SCRAPER.—J. BARON, El Centro, Cal. Mr. Baron's invention comprehends improvements whereby the operator may facilitate the dumping of the shovel and at the same time promote his own safety to such an extent that he can use one hand for managing the team and have full use of the other hand for manipulating the mechanism controlling the shovel—the driver preferably standing upon the footboard in front of the shovel.

MARINE SIGNAL.—G. E. LANE, Santiago de Cuba, Cuba. This invention has reference to signals such as are used aboard ship for indicating a ship's course, or for preventing such accidents as are likely from fogs. The object is to produce a mechanism of simple construction, which will operate to give a signal automatically, and the mechanism includes an arrangement for enabling it to operate the usual whistle, the siren or the bell.

MOVING SIGN.—A. N. JOHNSON, 825 National Reserve Bank Building, Kansas City, Mo. This device is for use more particularly in street cars, and the inventor's purpose is to provide an arrangement whereby a number of advertising cards may be displayed on an endless web. These cards are advanced intermittently, so that they move progressively along a frame. In this way the cards are made to have periods of rest in successive frames. After a complete cycle all cards on the web will have been presented to view.

Prime Movers and Their Accessories.

MIXER FOR GASEOUS FLUIDS.—F. F. THOMPSON, 681 D Avenue, Lawton, Okla. This improvement relates to the perfecting of the vaporization and mixing with air of the liquid fuel used in explosion engines. The invention is inserted between the carburetor and the engine, in the intake pipe, of any explosion engine, said carburetor and pipe being of ordinary construction. It supplements the work of the carburetor on any explosion engine, and overcomes defects due to imperfect carburetion.

PACKING BOX.—W. T. SNELL, Bisbee, Ariz. In this case the invention is directed to a packing box which is adapted for use on plungers of pumps and also on piston rods and valve-stems, the object being to provide a new and improved form of packing device which will effectively prevent leakage and which is simple in construction.

OIL BURNER.—W. E. FISHER, 829 West Main Street, New Iberia, La. The object of this improvement is the provision of a simple sensitive device for regulating the feed of oil and steam to the burner, operated by the pressure of steam generated, which will retain the pressure at practically a constant predetermined level, and wherein the said level may be varied.

INTERNAL COMBUSTION ENGINE OF THE TANDEM TYPE.—T. RIGBY, Station Hotel, Dumfries, Scotland. This invention relates to internal combustion engines of the tandem type, and particularly of the tandem vertical type, working on the single-acting Otto cycle, and the invention consists in supplying in such engines a supplemental charge of gas, air or gaseous combustible mixture under pressure to the power cylinder over and above the ordinary charge drawn into the cylinder by suction, the said supplemental quantity being admitted in accordance with the requirements of the load, but preferably only being brought into operation to meet an overload.

Railways and Their Accessories.

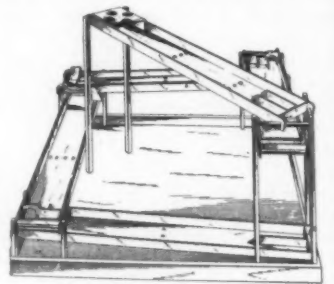
RAILWAY TRAIN AIR-PIPE COUPLING SYSTEM.—G. C. READ, Davenport, Toronto, Can. This invention provides coupling devices for the air operating train service

which are automatic in action; provides couplers having provision for manually operating the same; provides couplers to accommodate and compensate for the movement of car bodies independent of coupled trucks of adjacent cars; and provides couplers with mechanism for centering or aligning the coupling heads of adjacent cars.

RAIL FASTENER.—W. J. COOPER, Rodeo, Cal. Mr. Cooper's improvement relates generally to rail fasteners and more particularly it involves an improved form of spike which is adapted to be driven into position in a tie, the device having one end portion adapted to be positioned without the tie and held securely in relation thereto.

Pertaining to Recreation.

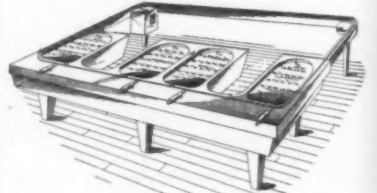
GAME APPARATUS.—D. J. BERON, 1762 Hancock Street, Glendale, Brooklyn, N. Y. The engraving is a perspective view showing the game apparatus complete. The invention relates to an apparatus whose mechanism is controllable partly by skill and partly by chance for playing an indoor game having more or less analogy to base-ball. It comprises parts representing a base-ball diamond



GAME APPARATUS.

or field, and various bases disposed about the same, the parts being disposed so that the balls may be rolled from base to base, and various other provisions being made for "strikes," "balls," "home runs," "base hits," and "putting out." The apparatus further comprises means whereby a ball (representing a player) reaches a base, it may have the effect of liberating other balls lodged upon other bases and located more or less distant from the ball which liberates them.

GAME APPARATUS.—A. REIBSTEIN, 48 Stuyvesant Street, Manhattan, New York, N. Y. The object of this invention is to provide a new and improved game apparatus, which is preferably called gun billiards, and arranged to require considerable skill in suc-



GAME APPARATUS.

cessfully playing the game, and to afford amusement to the players and the onlookers. For the purpose mentioned, use is made of a continually moving ball carrier having spaced supporting means for supporting balls carried past the muzzle of a manually-controlled gun, for knocking off the balls from the carrier onto a counting table having retaining means for the ball. In the accompanying illustration the game apparatus is shown in a perspective view.

Pertaining to Vehicles.

WIND SHIELDS.—J. O. HOFBAUER, 225 West Forty-ninth Street, Manhattan, New York, N. Y. This invention has reference more particularly to the combination with a vehicle having a front seat and a back seat, of a wind shield mounted adjacent to the front seat and movable into an operative position relative to the rear seat, the wind shield being movable into an operative position toward the front seat.

RESILIENT WHEEL.—J. W. ENRIGHT, 862 Tchoupitoulas Street, New Orleans, La. This invention relates to elastic tires or rims for the wheels of motor cars, carriages and other road vehicles. The wheel will serve all the purposes of a vehicle wheel with the usual pneumatic tire, by imparting thereto smooth and easy riding, and, at the same time, obviating the temporary uselessness of the latter, as is the case in a puncture or leak in the tire. The wheel takes up both horizontal and vertical thrusts against the outer rim of the wheel. The construction readily admits of access to resilient members and provides for members being held positively in place.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

LEGAL NOTICES

PATENTS

If you have an invention which you wish to patent you can write fully and freely to Munn & Co. for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention and a description of the device, explaining its operation.

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PATENT WANTED. Owners of processes for extraction of aluminum from kaolin; address particulars and royalty expected, W. C. Marshall, 38 Union Oil Building, Los Angeles, California.

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READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. In every case it is necessary to give the number of the inquiry. Where manufacturers do not respond promptly the inquiry may be repeated. **MUNN & CO., Inc.**

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Inquiry No. 9259.—Wanted, to buy a machine for removing the coating of a siphon.

Inquiry No. 9260.—Wanted, addresses of parties able to ship corundum, garnet, flint, emery or any material suitable as an abrasive.

Inquiry No. 9261.—Wanted, a manufacturer to make card games.

Inquiry No. 9262.—Wanted, to buy a glass which is a conductor of electricity, and the address of the makers of the same.

Inquiry No. 9263.—Wanted, name and address of manufacturer of pantalon stretchers with clamps, which is capable of being folded up.

Inquiry No. 9264.—Wanted, the name and address of manufacturers of Date Fitting Machines.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12622) W. M. says: Would it need a complete circuit for each light, in order to operate a battery of lights separately, one push button to a light? Is there any way of wiring in order to do this with one circuit? Can it be done with one return wire and a multiple of outgoing ones? Could it be done in any way by throwing a resistance in or out of the circuit? If a person was entirely without money, and had several ideas which he wished patented, how could he protect himself so as not to lose his patent rights when disclosing the idea to a prospective backer? Would an affidavit do? Is a new combination of old elements patentable? Is a new application of old elements patentable? A. Your expression, "battery of lights," we take it means a number of lights, each one of which is to be independently controllable at will; it is, of course, necessary, to do any work with an electric current, that a closed circuit be provided; therefore, in this case, if you were using, say, five lights, you would need five switches, one switch being connected in series with one lamp, all of the lamps and all of the switches being in circuit with your source of supply. Your question concerning the single return wire and the multiple of outgoing ones is therefore correct. We know of no way whereby the use of a resistance would effect the result which you desire, as the facts are understood.—There is no form of protection provided for under the patent laws except a patent, and there is no other course open to an inventor but to file an application. The first one to conceive an invention is entitled to a patent, even though he defers the application, provided, however, that he has been diligent in completing the invention, which under the law may be done by filing an allowable application for a patent, or by the prompt construction of a full-sized operative device. The inventor should be in a position to prove by the testimony of competent witnesses the disclosure of the invention at a given date, and also establish the date of each important step in the development of the invention, by the production of verified sketches, models, and other data. Where it is not possible for an inventor to file an application, nor to construct a full-sized operative machine, and he is making every effort to do so, then delay should not militate against him if he can prove priority in the conception, disclosure, etc. A new combination of old elements is patentable, when, by the action of the elements upon each other, or by their joint action on a common object, they perform additional functions and additional effects, something more than the mere sum of the results of the individual elements. The mere new use of an old device is not patentable; there may be something more involved, however, and the actual facts of the case should be submitted. The above answers to your patent questions are given by Munn & Co., Patent Attorneys, 361 Broadway, New York.

(12623) E. M. asks: 1. How does the log unwind the rope according to the velocity of the ship? Also send me a good idea of a log, describing it fully. A. Your question about a ship's log seems to refer to the old form of log, which was hove in the old days in each watch or when the ship went upon a new course. This log is a quarter of a circle or a triangular board weighted upon one edge with lead, so that it will stand upright in the water with that side down. In each corner is a hole. The log line has near its end three short lines attached. One of these ends is fastened to the corner of the log which will stand up when the log floats with its weighted edge down. The other two lines have wooden pins attached to them. The pins are put into the holes in the other two corners of the log. The log is thrown overboard. It floats upright in the water where it falls and remains there. The ship sails on and draws the line out for one minute. At the end of this time stout sailors seize the line as it runs out and hold it fast. The sudden jerk of the line pulls the pins out of the holes in the log, and it is drawn in aboard the ship by the line attached to the upper corner. The length of line which runs out in a minute is told off by the knots on it, and gives the knots per hour which the ship is making. Many other forms of logs are now in use which trail behind the ship and rotate, turning an indicator which registers the number of knots or nautical miles run by the vessel. We think the old-fashioned log is not much used to-day. 2. How does the atmosphere force the water up in a siphon? A. In a siphon the tendency is to form a vacuum in the bend at the top of the tube, because the water in each arm pulls down on its own side. Since one side is always longer than the other, the water in one side is heavier than it is in the other,



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and thus the flow is toward the longer arm of the siphon. As the water in the shorter arm is pulled up, there is a tendency to produce a vacuum there. The pressure of the air on the water in the pond or reservoir from which the water is being drawn forces the water up into the short arm of the tube, and so the flow is continuous. This you will find explained in all the text-books of elementary physics, such as are used in the high schools.

NEW BOOKS, ETC.

INCREASING HUMAN EFFICIENCY IN BUSINESS. A Contribution to the Psychology of Business. By Walter Dill Scott. New York: The Macmillan Company, 1911. 8vo.; 339 pp. Price, \$1.25 net.

The modern business man, Prof. Scott reminds us, is the true heir of the old magicians; his touch increases the value of things tenfold. The selection and handling of men is a factor of prime importance in any industry. By judicious application of the laws of psychology, great increase in individual efficiency is brought about. "We have a choice between wearing out and rusting out. Most of us have unwittingly chosen the rusting process." We cannot wholly accept this statement, but we must admit that another tenet of the writer's is indisputable—that many confuse overwork with what is really underwork accompanied by worry or unhygienic practices. Prof. Scott advocates spurring the worker to greater effort by a studied use of the good example, the competitive spirit, increased remuneration, and assured concentration, and declares it possible by these means to increase the average efficiency fifty per cent. We may demur before the sweep of some of the writer's arguments and conclusions, but we must admit the suggestive power of the work, which is wonderfully well written and makes fascinating reading.

THE DESIGN OF WALLS, BINS AND GRAIN ELEVATORS. By Milo S. Ketchum, C.E. New York: McGraw-Hill Book Company, 1911. 8vo.; 556 pp.; illustrated. Price, \$4 net.

This is a second edition containing one hundred and fifty pages of new material. Retaining-wall design has been the subject of much diverse speculation and theory. The solutions of Rankin and Coulomb are presented in separate chapters, with full diagrammatic demonstrations. Cain's formulas and Trautwine's rules are also given. In the second main division of the work the design of coal and ore bins is considered, with foundation and elevation plans of the bunkers and bins of the Lackawanna Steel Company. Part III takes up the design of grain bins and elevators. As reinforced concrete has come into quite general use for retaining walls, bins, and elevators, considerable space is devoted to the theory and formulas governing this method of construction. In fact, concrete, both plain and reinforced, forms the subject of a lengthy appendix. Other appendices give definitions of masonry terms, specifications for stone masonry, and specifications for steel structures. The work is a very thorough exposition of an important branch of building science.

THE WIDTH AND ARRANGEMENT OF STREETS. A Study in Town Planning. By Charles Mulford Robinson. New York: The Engineering News Publishing Company, 1911. 8vo.; 199 pp.; illustrated. Price, \$2 net.

The author has been a close student of Town Planning, and has had exceptional facilities for observation and the interchange of ideas, both here and in Europe. He is not an illogical extremist, either from the artistic or the utilitarian point of view; he does not, for example, unqualifiedly endorse the standardization of thoroughfares. Private interest has been given its share of consideration together with public welfare. The problem of transportation is treated with the respect due to its gravity. In short, the writer seems to have overlooked few of the factors necessary to the wise planning and artistic treatment of the city lay-out.

THE ORIGIN OF LIFE. Being an Account of Experiments with Certain Superheated Saline Solutions in Hermetically Sealed Vessels. By H. Charlton Bastian, M.D., F.R.S. New York: G. P. Putnam's Sons, 1911. 8vo.; 119 pp.; illustrated. Price, \$1.50 net.

For many years Prof. Bastian has conducted a systematic research into the origin of living matter. His experiments have been so dependent upon minute attention to detail, and his conclusions so opposed to the generally accepted theories, that the learned societies have hesitated to endorse these experiments and conclusions. In brief, his studies have led him to believe that, far from the life-originating process having occurred only once, in the dim past of the earth's existence, that process is being repeated daily; that is, he is an ardent believer in, and exponent of, so-called "spontaneous generation." Prof. Bastian meets with vigorous argument the suggestion that the bacteria found in his experimental tubes are dead organisms, previously contained in the fluid and destroyed by subsequent heat. He declares these "dead" organisms grow and multiply. His earnest aim is to induce scientists to repeat his experiments, so that his conclusions may be vindicated. Because it is as yet uncorroborated Bastian's work cannot be accepted by scientific men. The reason was given editorially in last week's *SCIENTIFIC AMERICAN*.

A Princely Gift for Technical Education

(Concluded from page 293.)

bankment, an educational plant truly unique. It is possible now to develop from the beginning a harmonious plan which shall be based on the experiences of half a century of successful technical instruction. Such plans have of course been considered in a tentative way at different times since it has seemed possible for the Institute to move from its present place in the heart of Boston. Two of the suggestions are here presented. One of them was drawn at the time when an inland location seemed possible, grouping the larger departments about a campus with an administration building for the front, the power plant entirely at one side, and the athletic grounds, symmetrically surrounded by society houses and dormitories. These suggestions as to buildings are approximately correct with reference to floor space, but of course in another location would be necessarily much modified in arrangements. The pen and ink sketch which is presented is an architect's conception of the possibilities of the Charles River embankment site. It is the general development of a suggestion made by Prof. Despradelle of the Architectural Department of the Institute, who a number of years ago at the request of a large owner of property here, prepared a sketch which has been modified and extended to accord in a way with the location now selected. While this cannot be considered in any way authoritative it does show the splendid opportunities that this site will present for the erection of a harmonious and dignified group of educational buildings. It will then be seen that for the Institute of Technology the gift means the possibility of supplementing the splendid location by a plant and equipment second to none of the kind in the world.

When the Royal Canadian Commission on Industrial Technical Education visited Boston only three months ago, a group of men better fitted than any other in this world by their recent experience for an opinion that is worth having, the members inspected the Institute of Technology. They expressed the highest opinion of its efficiency. "We think no school in the world is ahead of it," said Dr. Bryce of this Commission. "The people of Boston and its own graduates may well feel proud. Some schools have better buildings, but no other one seems to have teachers so well adapted to the work." "It astonishes us," said another commissioner, "to find such marvelous equipment in such plain factory buildings." The anonymous gift will afford to the Institute the means for remedying a part of this criticism, and for establishing its present superior equipment in conditions of more ample space, in which its value may be even greater.

What this gift means for the world is an exceedingly important consideration. It evidences in the first place what has already been set forth in the *SCIENTIFIC AMERICAN* that the business world is aware of the need of technically trained men. It is not necessary here to repeat the story of Dr. MacLaurin in his recent tour through the West where at alumni dinners in Philadelphia, Washington, Chicago, Minneapolis, Pittsburgh, and Rochester, the strong commercial men met him and expressed to him their conviction that technical education is the education for the future large business man. Such instruction can be secured only in institutions especially fitted for this work, and the present gift is the most convincing evidence of the existence of this opinion.

When the business man in touch with large affairs is ready to give so much of his money to a technical institution it is the highest evidence of the belief of the business world in the value of technical education. The truth is that technical training is coming into its own. It is the most recent important development of education, the whole history of which in this, or indeed in any other country, lies within the past half-century. For the world the gift to Technology is important, for it is but the beginning of support by business men of the educational institutions which train their students to be "usable," and makes of them important factors toward the improvement of business.

In his conversations with President

MacLaurin the donor shows that he is looking at the question of future education from the strictly business point of view. He believes that in this country we are only just beginning to realize the possibilities open to us through modern methods of business efficiency and the use of specially trained experts. It is only the fringes of possibility that have thus far been touched, and he says through proper methods there must arise developments that will be simply astounding. And he, the modest giver, is a type of the business man of large outlook, for which the country is famous.

And now, in closing, a few words about what the Institute of Technology is proposing to do. Of course every one is agog and is asking, when the new buildings will be erected? The establishment of a great group of school buildings is not a matter to be done offhand, like ordering a suit of clothes from the tailor. It is a work that requires time and consideration. The Institute has now the opportunity to build harmoniously and consistently, and this will be done with the greatest possible preparation for the future. All the circumstances are unusual, the site, the financial support and the importance of the school, and for that reason the manner of procedure is unusual. For a year the instructing staff has been at work, each group with the needs of its own department. Computations have been made as to room required and consideration has been given to the best disposition of the rooms. The instructors have been sent to other institutions to observe what in them there might be of the practical and efficient. Thus all the facts are to be gathered that may prove of importance to the new plant. Then there are the engineering problems to consider, and in an area of fifty acres, with the inter-relations of buildings and other constructions, grounds and undergrounds, there will be many of them. Toward the solution of these, John R. Freeman of Providence, one of the country's leading engineers has volunteered his services for a number of months the coming season. Then when educational and engineering problems have been pretty well considered, the architects will begin their work. By this method whatever of beauty in the architecture the specialists may be able to secure, the buildings and the land will be fundamentally prepared for their ultimate purposes.

All these things will require time. The New Technology will be no Aladdin's palace to spring up in the twinkling of an eye, but at the same time it will contain the lamp of enlightenment that is greater than that of the Chinese youth, for by constant rubbing it will illuminate and better the whole human race.

The Heavens in April

(Concluded from page 290.)

has been prepared. The three bright stars at the top are visible to the naked eye and are shown on the larger map, the brightest being Theta Geminorum. Those of the seventh magnitude can be seen with an opera-glass, those of the eighth with a field-glass of fair power, while the stars of magnitude $8\frac{1}{2}$ will require a powerful field-glass or a small telescope. There is nothing as bright as magnitude 9.5 between the Nova and the groups of stars above and below it, so that this chart will suffice for its identification until its brightness falls below this limit.

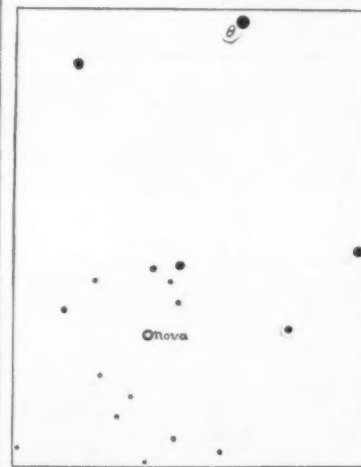
The spectrum of this interesting object has of course been carefully observed. Photographs taken at Harvard on March 13th showed a spectrum closely resembling that of Procyon, with dark hydrogen lines. On the following night a marked change had occurred, the hydrogen lines being bright on the edge toward the red, so that the spectrum closely resembled that of other new stars which had previously been observed. Photographs taken on the 13th at Ann Arbor showed the same bright lines. Prof. Pickering explains the apparent discrepancy by suggesting that the bright lines may at that time have been too narrow to show on the Harvard photographs which were taken with an instrument (objective prism) of quite different type from the slit spectroscopy used at Ann Arbor.

In any case it is clear that there will be preserved in this case a good record of the early stages in that remarkable

series of changes which the spectra of new stars present. It may be recalled that Nova Persel, of 1901, the only other new star discovered while still increasing in brightness, also showed a dark-line spectrum on the first day, which however resembled that of the typical stars in Orion, and not that of Procyon.

The probable theoretical explanation of the phenomena of new stars has already been discussed in these columns, in connection with Nova Persel and the previous Nova Geminorum of 1903.

The most satisfactory theory so far proposed seems to be Seeliger's, according to which the remarkable increase in luminosity of the star is due to its collision with a nebula, i. e., a cloud of meteorites, or cosmic dust, with perhaps more or less gas accompanying them. Such an encounter would bring about the fall of great quantities of meteoric material upon the star's surface, with enormous velocity, due principally to the attraction of the star itself. These particles, striking the star's atmosphere, would become incandescent, being heated by friction just as meteors are on entering the earth's atmosphere, but to a far higher degree. If the meteoric material was comparable in quantity with the mass of the star's atmosphere, the whole surface of the star would be heated to an exceedingly high temperature. At the same time violent currents would be set up in the atmosphere, which might explain the great displacement and complexity of the spectral lines. When once the star passed out of the dust cloud, its surface would receive no fresh supply of heat, and would very



Enlarged view of the region about Enebo's Nova.

rapidly cool. The influence of the whole encounter upon the star, though enormous at the surface, would be only skin-deep, which accounts for the fact that these new stars, after only a few years, return to their original brightness, or nearly so.

The theory thus sketched, though in the main very satisfactory, does not explain some things, notably the fact that Nova Persel, and now the present Nova, when caught "on the rise" showed a spectrum closely resembling that of an ordinary star. It may be hoped that the observations in this present case will help to clear up this difficulty.

With regard to the distance and real brightness of the Nova, we can only judge by analogy with those previously observed, which have in all the cases investigated been found to be beyond the range of exact measurement, and certainly not less than 100 light-years from the sun. If the present Nova is at this distance, it must at maximum have been not less than forty times as bright as the sun, and this is likely to be far too low an estimate.

Princeton University Observatory.

The World's Fleets—Enormous Increases

IT is a noteworthy fact, and one that does not appear to have received its proper measure of attention yet in this country, that at the present moment the principal nations of the world are about to embark, or have already begun work upon, naval programmes of almost unprecedented magnitude. By a curious coincidence this potent fact synchronizes with

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a demand for naval reduction, both here and in England, which, though probably not larger, is at any rate considerably louder than usual. It is proposed to set forth briefly what these new programmes are and what they portend, so that reasonable men may judge for themselves whether the moment has arrived when it would be wise, or even sane, to cut down an already very modest annual programme of two armored ships.

The French Chamber of Deputies has at last decided upon a definite scheme or "organic law" governing the expansion of the navy for the next few years. This nation has now in hand four dreadnoughts of 23,500 tons, armed with twelve 12-inch guns apiece, while in 1911 were completed the six formidable ships of the "Danton" class, carrying four 12-inch and twelve 9.4-inch. The new programme provides for the laying down of three dreadnoughts this year, two in 1913, two in 1914, four in 1915 and two in 1917, and of these the first three will carry ten 13.5-inch guns in five center-line turrets. Six scout cruisers are also to be built, and the total cost of the whole scheme is estimated at \$285,000,000. It is worth remarking that the only criticisms to which the programme has been subjected take the view that in face of the strength of the German fleet in the north and of the growing naval power of Italy and Austria in the south of Europe, the proposals are not sufficient to meet the legitimate needs of the country.

In the case of Russia, Admiral Grigorovitch, who was appointed Minister of Marine less than a year ago, finds much less trouble in getting money for naval expansion than his predecessors. Four dreadnoughts with twelve 12-inch guns apiece have been launched in the Baltic, and in October three, to be armed with ten 14-inch, were laid down on the Black Sea. A new programme for the Baltic has now been prepared by which the strength of the fleet in those waters is to be raised to 16 battleships, 8 battle cruisers, 16 small cruisers, 72 destroyers and 24 submarines, the total cost of the necessary work being \$250,000,000. In the present year it is proposed to lay down four battle cruisers of 28,000 tons, armed with either eight or ten 14-inch guns, their individual cost being, owing to the high cost of construction in Russia, no less than \$20,000,000.

Perhaps of the greatest interest and importance to America, however, is the proposed increase in the Japanese fleet. At present this nation has no all-big-gun ships in service, but the "Aki" and "Satsuma," armed with four 12-inch and twelve 10-inch apiece, are very formidable ships, as are also the cruisers "Tsukuba," "Ikoma," "Kurama," and "Ibuki," all of which have four 12-inch for their main armament. The dreadnoughts "Kawachi" and "Settsu," each carrying twelve 12-inch, are approaching completion, while four battle cruisers, to be armed with eight 14-inch, are on the stocks, one in England ("Kongo") and three in Japan ("Hiyei," "Haruma," and "Kirishima"). A battleship of 30,000 tons ("Fusoo") is to be laid down at Kure shortly, and it is stated by the *Jiji Shimpō* that 15-inch weapons will be mounted in this ship.

Already, therefore, there are seven dreadnoughts building or about to be laid down for the Japanese fleet, besides which there are six ships completed which may be regarded as equal to many early vessels of the single caliber type. On top of this ambitious scheme of work it was announced recently by the *Asahi Shimbun* that Admiral Saito, Minister of Marine, has laid down as a minimum programme for the period from 1913 to 1920 the construction of eight battleships and eight cruisers of the super-dreadnought class, all to be completed by the latter year.

It is well known that the provisions of the German navy law are to be extended this year, probably by six, possibly by only three battle cruisers, though at the moment no authentic details are available.* With regard to Japan, however, there are the following important facts to be con-

* Germany's answer to the recent speech of Winston Spencer Churchill, First Lord of the British Admiralty, is given this week by the submission to the Federal Council of the new Navy Bill unaltered.

The measure, according to the *Nord-Deutsche Allgemeine Zeitung*, calls for an extra battle squadron, for which three additional battleships and two cruisers are to be constructed before 1920. The estimated additional annual cost is \$24,250,000 in 1912, \$31,750,000 in 1913 and \$28,500,000 yearly after that.

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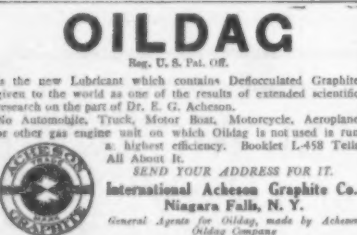
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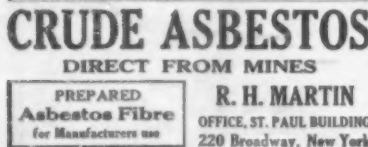
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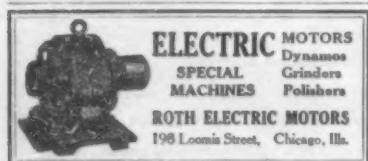
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sidered. Should the new programme be adopted and executed to time Japan will in 1920 possess twenty-three ships of the all-big-gun type, that is to say, the seven now under way or authorized, and the sixteen provided for in Admiral Saito's demands. Only two of these ships, the "Kawachi" and "Settsu," will carry a gun as small as the 12-inch. Now, even if the policy of laying down two ships a year for the American navy be continued, what will be our position in 1920? It is the practice now to complete the ships roughly three years from the date of their authorization, so that the newest and latest vessels available in 1920 would, if this policy be continued, be those provided for in 1917. The strength of the American dreadnought fleet in 1920 would thus be as follows:

Authorized.	Ships.	Number
1905	"Michigan," "South Carolina"	2
1907	"Delaware," "North Dakota"	2
1908	"Florida," "Utah"	2
1909	"Wyoming," "Arkansas"	2
1910	"New York," "Texas"	2
1911	"Nevada," "Oklahoma"	2
1912	Prospective programme	2
1913	Prospective programme	2
1914	Prospective programme	2
1915	Prospective programme	2
1916	Prospective programme	2
1917	Prospective programme	2
Total		24

Of the above ships the first eight are armed with 12-inch guns. The point to be borne in mind, then, is this. Even if America continues to lay down two dreadnoughts or super-dreadnoughts a year her strength in this type of ship in 1920 will, as compared with that of Japan, be as follows, on the assumption, of course, that the new Japanese programme is adopted and completed to time:

	Completed Dreadnoughts in 1920.	America.	Japan.
Armed with 12-inch guns	8	2	
Armed with 14-inch guns	4	4	
Armed with 14-inch or heavier guns	12	17	
	24	23	

It is surely only necessary to enumerate the facts to impress upon the country the seriousness of the position and the folly of even thinking of reduction.

Requirements for Military Aeroplanes and Aviators

ANNOUNCEMENT was made by the War Department on January 22nd last that eight or ten new aeroplanes would be added to the Signal Corps equipment between March 1st and June 30th. Brigadier-General James Allen, Chief of the Signal Corps, is making use of the \$65,000 remaining out of the \$125,000 appropriation of last year for this purpose. He has formulated a number of requirements that the new machines must fulfill. There will be two types of machines, viz., speed machines and weight-carrying aeroplanes. The requirements, as announced, are as follows:

Requirements for Weight-carrying Military Aeroplane.

1. It must carry two persons with the seats so arranged as to permit of the largest possible field of observation for both.
2. The control must be capable of use by either operator from either seat.
3. The machine must be able to ascend at a minimum rate of 2,000 feet in 10 minutes while carrying a weight of 450 pounds, and the amount of fuel stated in paragraph 4.
4. The fuel supply must be sufficient for at least four hours of continuous flight.
5. It must be easily transportable by road, rail, etc., and easily and rapidly assembled and adjusted.
6. The starting and landing devices must be part of the machine itself, and it must be able to start without outside assistance.
7. The engine must be capable of throttling to run at reduced speed.
8. The engine will be subject to an endurance test in the air of two (2) hours continuous flight.
9. The aeroplane must develop a speed in the air of at least forty-five miles an hour.
10. The machine must be capable of landing on and arising from plowed fields.

11. The supporting surfaces must be of sufficient area to insure a safe gliding angle in case the engine stops. This will be determined by a test during calm atmospheric conditions; at an altitude of 1,000 feet the engine will be entirely cut off and a glide made to the ground. The horizontal distance between position of cut-off and landing must be at least 6,000 feet, or at other altitude at the same ratio.

NOTE.—In case the weight-carrying capacity is increased to 600 pounds, the minimum speed may be reduced to 38 miles per hour, and the climbing power diminished to sixteen hundred feet in ten minutes.

On February 12th five new biplanes of the Wright type were ordered. Three of these are to be weight-carrying machines capable of carrying two men and an additional weight of more than 100 pounds, while a fourth will be a speed machine capable of flying, when fully loaded, at a speed of 65 miles an hour. The fifth aeroplane is to be a Burgess-Wright machine equipped with a 60-horse-power, 6-cylinder motor and having a speed of 50 miles an hour or more. All of these aeroplanes, in fact, will be fitted with the latest Wright 6-cylinder motors provided with mufflers.

The first of these machines to be delivered will be the speed biplane, which, it is expected, will arrive at College Park, Md., within the next month. Last week there was delivered to the Army Aviation School at Augusta, Ga., a new 75-horse-power Curtiss military biplane that was ordered last December. This machine, at the time of our going to press, had fulfilled all the conditions mentioned in the list of requirements except the third condition, namely, the development of climbing speed of 200 feet per minute while carrying a weight of 450 pounds. Aviator Charles F. Walsh had, however, increased the supporting surface of the upper plane from its former spread of 38½ feet to a total of 43 feet by adding extra panels. On the 20th inst. he flew the machine without load for 2 hours and 11 minutes and demonstrated its climbing ability to be excellent, so there is little doubt that he will succeed in fulfilling all of the conditions. Among these is starting from and alighting upon a plowed field (which was fulfilled successfully); also the tearing down of the aeroplane and making it ready for shipment in one hour and the reassembling and making ready for flight in two hours' time. As this has been accomplished by two men many times by the Curtiss force while on the road giving exhibition flights, there is no doubt about the machine meeting these requirements. The latest record of assembling made in France with a Blériot monoplane is 17 minutes for the removing of the machine from the automobile van, putting on the wings, and soaring in the air; but the monoplane is a much easier machine to assemble, which accounts for this great rapidity.

There are now six army aeroplanes at Augusta and six aviators to pilot them. In all probability the machines will be brought to College Park, Md., early next month, and a systematic training of new army aviators will be begun. It has lately been decided to train officers of the National Guard as military aviators as well as the officers of the regular army, and the following qualifications for military aviators have been approved by the Secretary of War:

"Military aviators must be commissioned officers of the regular army or organized militia.

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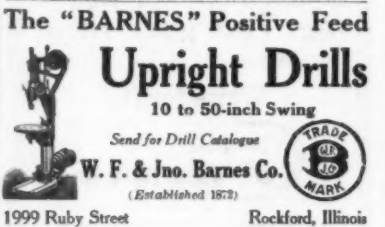
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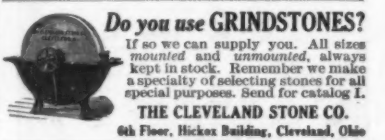
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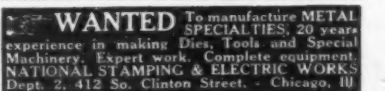
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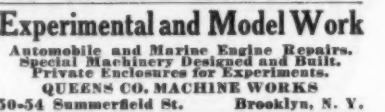
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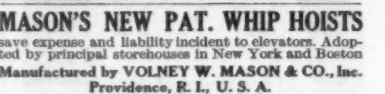
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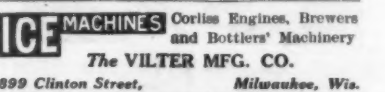
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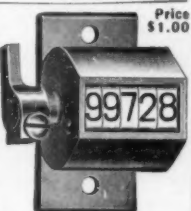
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rest within 150 feet of a previously designated point, the engine being completely cut off prior to touching the ground. The combined weight of passenger and pilot must be at least 250 pounds.

"5. Execute a volplane from an altitude of at least 500 feet with the engine completely cut off, and cause the aeroplane to come to rest within 300 feet of a previously designated point on the ground.

"6. Make a military reconnaissance flight of at least 20 miles for the purpose of observing and bringing back information concerning features of the ground or other matter which the candidate is instructed to report upon. This flight must be made at an average altitude of 1,500 feet.

"The tests for Military Aviators will be conducted under the direction of the Chief Signal Officer of the army, at such times and places, and before such boards of officers as may be convenient. The names of officers who qualify and the date of such qualification will be reported to the Adjutant General of the army."

If any National Guard officer wishes to become an aviator, when his application has been approved by the Secretary of War, he will be detailed to the nearest convenient aviation camp of the army and will be taught by the army aviators until he is able to qualify for this military license. The first applicant was Lieut.-Col. C. V. Winder, of the Ohio National Guard, who arrived at the Augusta Aviation School on the 12th inst. He is being taught to operate a Wright biplane by Lieut. Kirtland. Despite a great flood, which completely covered the aviation field, a total of thirty flights were made by the aviators in three days, the second week in March, and the total duration of four hours and 57 minutes in the air was scored.

International Congress of Chambers of Commerce

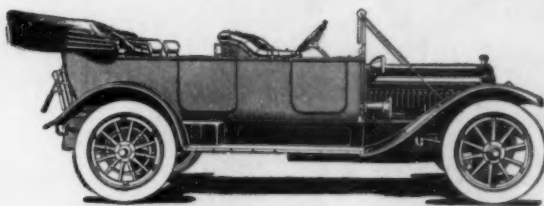
AN International Congress of the Chambers of Commerce will be held in Boston on September 24th to September 28th, 1912. The organization represents the business men of the entire world. The delegates will be composed of representatives of the leading governments and of the leading business organizations of the world. The purpose of the congress is to facilitate the commercial intercourse of nations and to secure harmony of action on all international questions affecting commerce and trade.

The first International Congress of the Chambers of Commerce was held at Liège, Belgium, in 1905; the second in Milan, Italy, in 1906; the third at Prague, Austria, in 1908, and the fourth in London, England, in 1910.

These congresses have given consideration to a large variety of problems affecting international commercial relations. The subjects before the congress are discussed at regular sessions and voted upon. If the action taken by the congress is favorable, it becomes the duty of the permanent committee to take steps to make the decision of the congress effective. This is done either by interesting some government to the extent of calling a diplomatic conference of nations or by entering directly into negotiations with the different governments. The method is illustrated by the recent success which the permanent committee attained in interesting Holland in uniformity of legislation on bills of exchange; Belgium on uniformity in customs statistics; Switzerland in a fixed international calendar and a permanent day for Easter, and Italy in the organization and institution of a program for an international maritime union.

The subjects tentatively agreed upon for discussion at the forthcoming meeting this year are: The establishment of a permanent international court of arbitral justice, composed of judges representing the different judicial systems of the world and capable of insuring continuity of jurisprudence and arbitration; the unification of legislation relating to checks; international postal reforms; commercial statistics and the immediate institution of an international office; an international maritime union; the regulation of expositions; an international agreement between banks of issue; a suggestion looking to the preparation of a resolution intended for the suppression of measures taken against foreign merchants on account of their religion.

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